Instruction Manual

FLUKE

ELECTRONICS FOR INDUSTRY
INSTRUMENTS / COMPONENTS

JOHN FLUKE MFG. CO., INC.
P.O. Box 7428 Seattle, Washington 98133

© Copyright, John Fluke Mfg. Co., Inc.
October, 1968

MODEL 853A
DIFFERENTIAL MULTIMETER

853A serial no. _____ and above

© COPYRIGHT, JOHN FLUKE MFG. CO., INC., 1969

TABLE OF CONTENTS

Section	Title	Page
I	INTRODUCTION AND SPECIFICATIONS	1-1
	1-1. Introduction	1-1
	1-4. Specifications	1-1
	1-5. DC Voltmeter	1-1
	1-6. AC Voltmeter	1-1
	1-7. DC Ammeter	1-1
	1-8. AC Ammeter	1-1
	1-9. Ohmmeter	1-2
	1-10. Environmental	1-2
	1-11. General	1-2
	1-12. Mechanical	1-2
II	OPERATING INSTRUCTIONS	2-1
	2-1. Introduction	2-1
	2-4. Operating Features	2-1
	2-6. Operation From 115/230 Volt Power Lines	2-1
	2-9. Preliminary Operating Procedures	2-1
	2-11. Operational Test	2-3
	2-15. Operation as a Direct DC Voltmeter or Ammeter	2-4
	2-17. Operation as a Differential DC Voltmeter or Ammeter	2-4
	2-19. Operation as a Direct AC Voltmeter or Ammeter	2-4
	2-21. Operation as a Differential AC Voltmeter or Ammeter	2-5
	2-23. Operation as a Direct Ohmmeter	2-5
	2-25. Operation as a Differential Ohmmeter	2-5
	2-27. Applications	2-5
	2-28. Introduction	2-5
	2-30. Measurement of Voltage or Current Excursions About a Nominal Value	2-5
	2-32. Use as a Null Detector	2-6
	2-34. Measurement of High Resistances	2-7
	2-36. Testing of Transistors	2-7
	2-38. Measurement of DBM	2-7
	2-40. Operating Notes	2-8
	2-41. Measurements of Isolated AC Voltages or Current	2-8
	2-43. Overload Protection	2-8

Continued ii

Continued (Table of Contents)

Section	Title	Page
III	THEORY OF OPERATION	3-1
	3-1. Introduction	3-1
	3-3. Block Diagram Analysis	3-1
	3-4. Introduction	3-1
	3-6. DC Voltmeter Modes	3-2
	3-9. AC Voltmeter Modes	3-2
	3-12. DC Ammeter Modes	3-3
	3-14. AC Ammeter Modes	3-3
	3-16. Direct Ohmmeter Mode	3-3
	3-18. Differential Ohmmeter Mode	3-5
	3-20. Circuit Description	3-5
	3-21. Introduction	3-5
	3-23. The Power Supply/Battery Charger	3-5
	3-26. The Voltage Regulator/Reference Supply	3-6
	3-29. The Inverter/Isolator	3-6
	3-32. The Null Detector Amplifier	3-6
	3-35. The AC-DC Converter	3-7
	3-38. The Reference Divider	3-7
	3-40. The Decade Potentiometer	3-8
	3-42. The Input Divider	3-8
	3-44. The Current Shunts	3-8
	3-46. The Range and Mode Switches	3-8
IV	MAINTENANCE	4-1
	4-1. Introduction	4-1
	4-5. Service Information	4-1
	4-8. General Maintenance	4-1
	4-9. Periodic Cleaning	4-1
	4-12. Replacement of Fuses	4-1
	4-14. Battery Replacement	4-2
	4-16. BAT CHG Lamp Replacement	4-3
	4-18. Precalibration and Troubleshooting	4-3
	4-19. Introduction	4-3
	4-22. Voltage Regulator/Reference Supply Check	4-3
	4-25. Inverter/Isolator Checks	4-5
	4-28. AC-DC Converter Checks	4-6
	4-31. Null Detector Amplifier Checks	4-7
	4-34. Calibration Procedures	4-11
	4-35. Introduction	4-11
	4-39. Meter Mechanical Zero Adjust	4-11
	4-41. DC Voltmeter Mode Calibration	4-12
	4-43. Decade Potentiometer Calibration	4-12
	4-45. DC Ammeter Calibration	4-14
	4-47. AC Voltmeter Calibration	4-16
	4-49. AC Ammeter Calibration	4-18
	4-51. Ohmmeter Checks	4-19

Continued iii

Continued (Table of Contents)

Section	Title	Page
V	LIST OF REPLACEABLE PARTS	5-1
	5-1. Introduction	5-1
	5-3. Columnar Information	5-1
	5-4. How to Obtain Parts	5-2
	5-7. List of Abbreviations	5-2
	5-8. Serial Number Effectivity	5-20
VI	ACCESSORY AND OPTION INFORMATION	6-1
	6-1. Introduction	6-1
	6-3. Accessory Information	6-1
	6-5. Option Information	6-1
	MODEL 853A OPTION 01	
	APPENDIX A	
	JOHN FLUKE MFG. CO. WARRANTY	
	LIST OF SALES REPRESENTATIVES	
	LIST OF FACTORY AUTHORIZED SERVICE CENTERS	
	SCHEMATIC DIAGRAMS	
	Multimeter (1 of 2)	1
	Multimeter (2 of 2)	1
	Voltmeter Mode AC & DC	2
	Ammeter Mode AC & DC	3
	Ohmmeter Mode	4
	Wiring Diagram	5

LIST OF ILLUSTRATIONS

Figure	Title	Page
Frontispiece	Model 853A Differential Multimeter	
1-1.	Model 853A Outline Drawing	1-2
2-1.	Model 853A Operating Features	2-2
2-2.	115/230 Volt AC Power Connections	2-3
2-3.	Bridge Detector - Floating Supply	2-6
2-4.	Bridge Detector - Floating Null Detector	2-6
2-5.	Measurement of High Resistances - Circuit Connections	2-7
2-6.	Transistor Testing Data	2-7
2-7.	AC Voltage to DBM Conversion Table	2-7
3-1.	DC Voltmeter Block Diagram	3-1
3-2.	AC Voltmeter Block Diagram	3-2
3-3.	DC Ammeter Block Diagram	3-3
3-4.	AC Ammeter Block Diagram	3-4
3-5.	Direct Ohmmeter Block Diagram	3-4
3-6.	Differential Ohmmeter Block Diagram	3-5
4-1.	Required Test Equipment	4-2
4-2.	Location of A2F1	4-3
4-3.	Location of A4DS1	4-3
4-4.	Adjustments and Test Points	4-4
4-5.	Regulation Test - Equipment Connections	4-4
4-6.	Voltage Regulator/Reference Supply Transistor Voltages	4-5
4-7.	Inverter/Isolator Transistor Voltages and Waveforms	4-5
4-8.	AC-DC Converter Checks - Equipment Connections	4-6
4-9.	AC-DC Converter Checks	4-7
4-10.	AC-DC Converter Transistor Voltages and Waveforms	4-7
4-11.	Null Detector Amplifier Voltage Mode Checks - Equipment Connections	4-8
4-12.	Null Detector Amplifier Current Mode Checks - Equipment Connections	4-9
4-13.	Null Detector Amplifier Transistor Voltages and Waveforms	4-10
4-14.	DC Voltmeter-Calibration Equipment Connections	4-11
4-15.	DC Voltage Range Checks	4-12

Continued v

Continued (List of Illustrations)

Figure	Title	Page
4-16.	Decade Potentiometer - Calibration Equipment Connections	4-13
4-17.	Decade Potentiometer Checks	4-13
4-18.	Location of Vernier Readout Dial Coupler	4-14
4-19.	DC Ammeter .1 MA to 1000 MA - Calibration Equipment Connections	4-14
4-20.	DC Ammeter Range Checks	4-15
4-21.	DC Ammeter 10 AMP Range - Calibration Equipment Connections	4-15
4-22.	AC Voltmeter - Calibration Equipment Connections	4-16
4-23.	1 Volt AC Range Checks	4-17
4-24.	10 Volt AC Range Checks	4-17
4-25.	100 Volt AC Range Checks	4-17
4-26.	AC Ammeter MA Range - Calibration Equipment Connections	4-18
4-27.	10 MA AC Range Checks	4-19
4-28.	100 MA AC Range Checks	4-19
4-29.	1000 MA AC Range Checks	4-19
4-30.	AC Ammeter 10 AMP Range - Calibration Equipment Connections	4-20
4-31.	Direct Ohmmeter Checks	4-20
4-32.	Differential Ohmmeter Checks	4-20
5-1.	Model 853A Differential Multimeter	5-3
5-2.	Printed Circuit Board Assembly	5-8
5-3.	Range Switch Assembly	5-11
5-4.	Mode Switch Assembly	5-13
5-5.	Final Assembly	5-15
5-6.	Decade Potentiometer, Deck "A" and "B" Assemblies	5-18
5-7.	Front Panel Assembly	5-19

MODEL 853A DIFFERENTIAL MULTIMETER

SECTION I

INTRODUCTION AND SPECIFICATIONS

1-1. INTRODUCTION

1-2. The Fluke Model 853A Differential Multimeter is a compact transistorized multimeter which allows conventional or differential measurement of dc or ac voltage, dc or ac current, and resistance. Voltage measurements may be made from zero volts to 1000 volts in four ranges. Current measurements from zero to 10 amperes are made in six ranges. Resistance measurements from zero to 100 megohms are made in seven ranges. The use of one meter scale for all ranges greatly simplifies all measurements. When the instrument is operated in the differential mode, an in-line digital readout is available from the front panel readout dials.

1-3. The Model 853A is designed for portable field or factory applications as well as for laboratory use and operates from line power or an internal 22 1/2 volt battery. The carbon battery may be replaced with a rechargeable nickel-cadmium battery pack by installation of option kit 853A-7001. Upon installation of this option kit, the instrument is identified as the Model 853A-01 on the rear panel metal decal. A tilt down carrying handle detents into the instrument's feet to serve as a tilt bail during bench top use of the instrument.

1-4. SPECIFICATIONS

1-5. DC VOLTMETER

RANGE
1, 10, 100, 1000 volts dc (with 11% overranging capability in differential modes).

ACCURACY
Differential
±(0.2% of reading + 0.02% of range).
Direct
±2% of full-scale.

INPUT RESISTANCE
11 megohms.

1-6. AC VOLTMETER

RANGE
1, 10, 100, 1000 volts ac (with 11% overranging capability in differential mode).

ACCURACY
Differential
±(0.5% of reading + 0.05% of range) from 30 Hz to 20 kHz.
±(1% of reading + 0.05% of range) from 20 Hz to 30 kHz.
Direct
±2% of full-scale from 20 Hz to 30 kHz.

INPUT IMPEDANCE
1 megohm.

1-7. DC AMMETER

RANGE
0.1, 1, 10, 100, 1000 milliamperes and 10 ampere (with 11% overranging capability in differential mode).

ACCURACY
Differential
±(0.2% of reading + 0.02% of range)
±(0.5% of reading + 0.05% of range) on 10 ampere range.
Direct
±2% of full-scale.

INSERTION LOSS
100 to 300 millivolt drop on all ranges.

1-8. AC AMMETER

RANGE
0.1, 1, 10, 100, 1000 milliamperes and 10 ampere (with 11% overranging in differential mode).

ACCURACY
Differential
±(0.5% of reading + 0.05% of range) from 30 Hz to 10 kHz.

±(0.5% of reading + 0.05% of range) from 30 Hz to 3 kHz on 10A range.
±1% from 20 Hz to 20 kHz.

Direct
±2% of full-scale from 20 Hz to 20 kHz.

INSERTION LOSS
100 to 300 millivolt drop on all ranges.

1-9. OHMMETER

RANGE
100 ohms, 1000 ohms, 10 kilohm, 100 kilohm, 1 megohm, 10 megohm, 100 megohm (with 11% overranging in differential mode).

ACCURACY
Differential
±(0.2% of reading + 0.01% of range)
±0.5% of reading above 10 megohms

Direct
±3% of full-scale.

1-10. ENVIRONMENTAL

OPERATING TEMPERATURE RANGE
Meets all specifications from 10° C to 40° C derated at 100 ppm/° C + 30 ppm of range beyond these limits to 0° C and 55° C.

STORAGE TEMPERATURE RANGE
Model 853A -40° C to +70° C.
Model 853A-01 -40° C to +50° C.

HUMIDITY
Within specifications to 40° C at 70% relative humidity.
Within specifications to 35° C at 80% relative humidity.

SHOCK
Meets requirements of MIL-E-16400F.

VIBRATION
Meets requirements of MIL-T-945A and MIL-E-16400F.

1-11. GENERAL

ELECTRICAL DESIGN
Completely solid state.

OVERLOAD PROTECTION
Withstands 1200 volts rms on any voltage range; 12 amperes rms on 10 ampere range, 2 amperes on all other current ranges (fused above 2 amperes); 120 volts rms on the 100 ohm through 10 kilohm ranges; 230 volts rms on the 100 kilohm through 100 megohm ranges.

SEMICONDUCTOR PROTECTION
The Model 853 will not injure typical semiconductors in any range or mode.

INPUT POWER

MODEL 853A. 115/230 volts ac ±10%, 50 to 500 Hz, at approximately 3 watts, or 22 1/2 volt "B" battery which provides 80 hours of operation.

MODEL 853A-01. 115/230 volts ac ±10%, 50 to 500 Hz, at approximately 6 watts. Minimum of 40 hours operation on rechargeable nickel-cadmium batteries.

1-12. MECHANICAL

WEIGHT
Approximately 10 lbs.

OPTION KIT 853A-7001
Used to convert the Model 853A battery power from a carbon battery to rechargeable nickel-cadmium batteries.

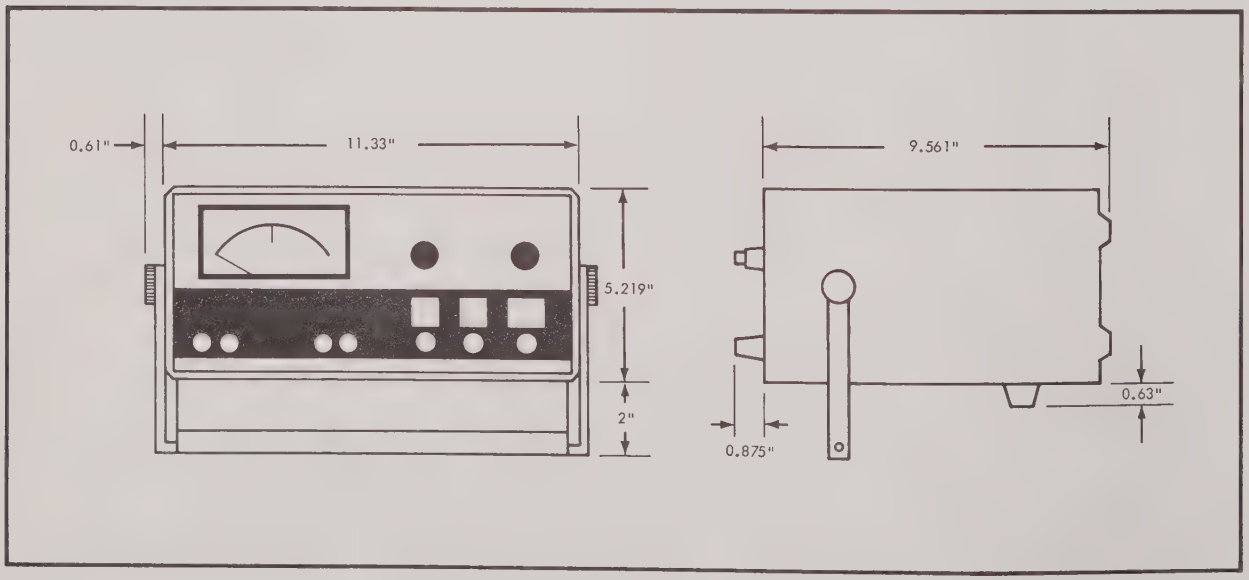


Figure 1-1. MODEL 853A OUTLINE DRAWING

SECTION II

OPERATING INSTRUCTIONS

2-1. INTRODUCTION

2-2. This section of the manual contains information necessary for you to effectively operate your Model 853A Multimeter. It is recommended that you thoroughly read and understand this section of the manual before attempting to operate your instrument.

2-3. Should any difficulties be encountered during the operation of your instrument, please feel free to contact your nearest John Fluke Sales Representative or write directly to the John Fluke Mfg. Co., Inc. with a statement of your problem. A complete list of Sales Representatives in contained at the rear of this manual.

2-4. OPERATING FEATURES

2-5. All of the Model 853A input terminals, indicator, and controls are illustrated and described in Figure 2-1.

2-6. OPERATION FROM 115/230 VOLT POWER LINES

2-7. The Model 853A may be operated from either 115 or 230 volts ac. The instrument's input power transformer is equipped with a dual wound primary which, when the windings are connected in parallel, allows the instrument to be operated from 115 volts ac, or when the windings are connected in series, allows the instrument to be operated from 230 volts ac.

2-8. The Model 853A is usually shipped wired for operation from a 115 volts ac source. However, if requested, the instrument is wired at the factory for operation from 230 volts ac and will be marked as such on the rear panel decal. To convert your instrument from 115 to 230 or from 230 to 115 volts ac input power, proceed as follows:

a. Disconnect the Model 853A line power plug and place the MODE switch to off.

b. Remove the four screws that secure the top cover to the Model 853A and remove the top cover from the instrument.

c. Locate the printed circuit board eyelet connections illustrated in Figure 2-2.

d. Solder the jumper wires, as illustrated in Figure 2-2, for the desired 115 or 230 volt ac input power configuration.

2-9. PRELIMINARY OPERATING PROCEDURES

2-10. Connect the Model 853A line plug to 115 volts ac (or to 230 volts ac if the instrument is so wired), 50 to 440 Hz, single phase three-wire outlet. If your instrument is a Model 853A perform the procedures described in steps a through c. If your instrument is a Model 853A-01, perform the procedures described in steps a, b, and d.

WARNING!

The round pin on the polorized three-prong plug connects the instrument's case to power system ground. Verify that the ac outlet is provided with the earth ground wire normally found with a three wire single phase connector. If the third wire is not grounded or if an adapter is used from a two wire connector, ensure that the instrument ground wire is connected to a high quality earth ground except during ac voltage or current measurements as described in paragraph 2-20.

a. Place the MODE and RANGE switches to the desired measurement positions.

b. To operate your instrument on the internal batteries, place the MODE switch to the BAT CHK position and note the meter reading. Minimum acceptable meter deflection is 0.2. If the batteries have an adequate charge, disconnect the line power cord. The instrument will now operate on the internal batteries when the MODE switch is placed to the desired measurement mode.

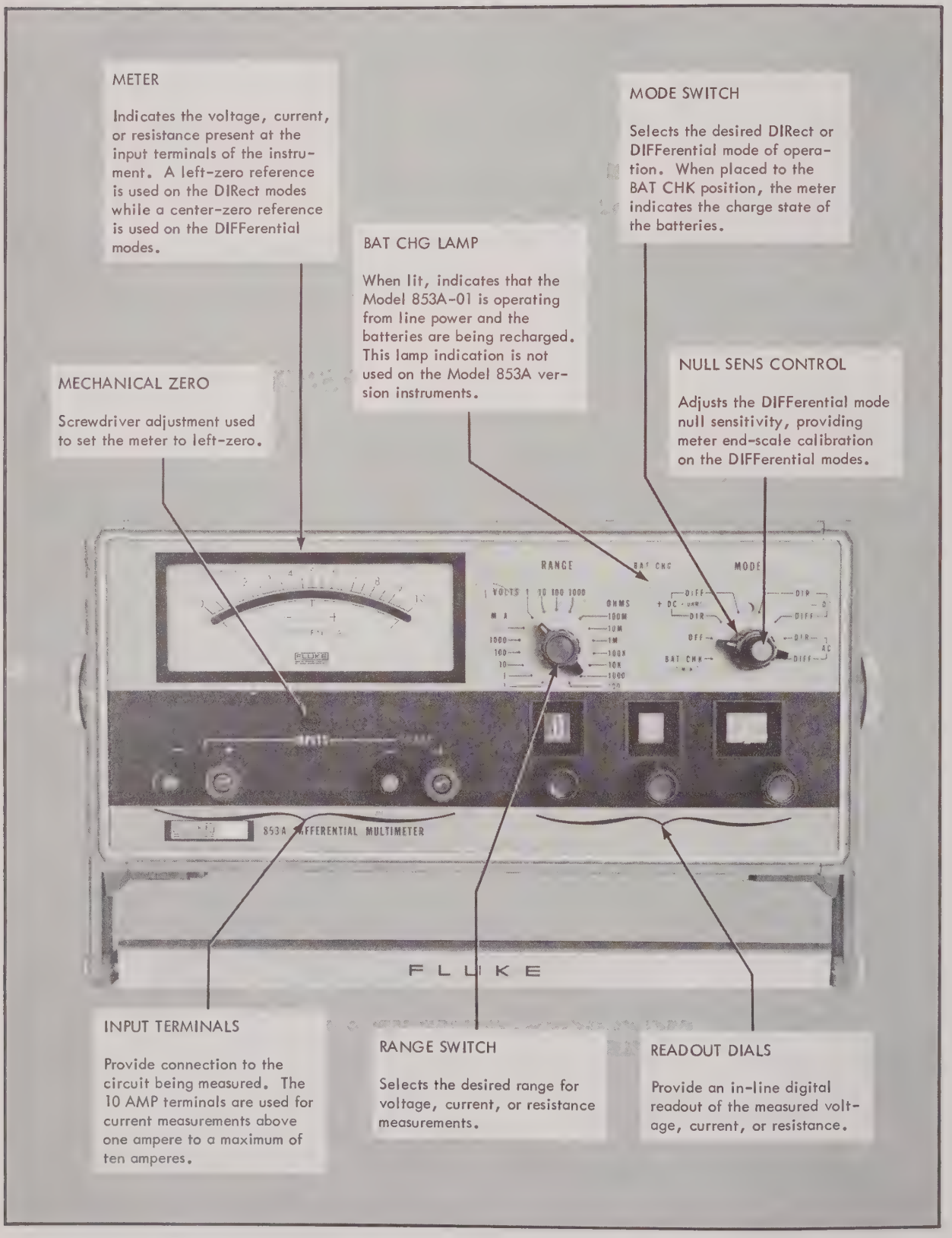

METER
Indicates the voltage, current, or resistance present at the input terminals of the instrument. A left-zero reference is used on the DIRect modes while a center-zero reference is used on the DIFFerential modes.
MODE SWITCH
Selects the desired DIRect or DIFFerential mode of operation. When placed to the BAT CHK position, the meter indicates the charge state of the batteries.
BAT CHG LAMP
When lit, indicates that the Model 853A-01 is operating from line power and the batteries are being recharged. This lamp indication is not used on the Model 853A version instruments.
MECHANICAL ZERO
Screwdriver adjustment used to set the meter to left-zero.
NULL SENS CONTROL
Adjusts the DIFFerential mode null sensitivity, providing meter end-scale calibration on the DIFFerential modes.
RANGE
BAT CHG
MODE
853A DIFFERENTIAL MULTIMETER
FLUKE
INPUT TERMINALS
Provide connection to the circuit being measured. The 10 AMP terminals are used for current measurements above one ampere to a maximum of ten amperes.
RANGE SWITCH
Selects the desired range for voltage, current, or resistance measurements.
READOUT DIALS
Provide an in-line digital readout of the measured voltage, current, or resistance.

Figure 2-1. MODEL 853A OPERATING FEATURES

Note!

The BAT CHK position of the MODE switch is spring loaded on instruments having a serial number of 123 through 147.

c. If the Model 853A fails the battery check, replacement of the battery is necessary. Refer to Section IV for battery replacement.

d. If the Model 853A-01 fails the battery check, operate the instrument on line power until the batteries are adequately charged. Should the batteries fail the battery check after the instrument has been operated for 16 hours on line power, replacement of the batteries may be necessary. Refer to Section IV for battery replacement.

2-11. OPERATIONAL TEST

2-12. The following information is provided for the operator to initially determine instrument operation. These tests will check relative instrument operation and are not intended as instrument performance checks. Should you desire to check the instrument's accuracy against the specifications contained in Section I, refer to the Calibration Procedures contained in Section IV of this manual. These procedures, by disregarding the adjustments, can be used as Instrument Performance Tests.

2-13. The only requirement for the following tests is a shorting jumper. To determine relative instrument operation, perform the operations described in the Preliminary Operating Procedures (paragraphs 2-9 and 2-10) and proceed as follows:

a. Place the Model 853A controls as follows:

MODE	AC DIFF
RANGE	1 VOLT
NULL SENS	Maximum clockwise
Readout dials	.000

b. Rotate the extreme right hand readout dial clockwise, observing that the meter deflects to the left. Return the right hand readout dial to 0 upon completion of this step.

c. Rotate the center readout dial clockwise to each available position, observing that the meter deflects to full-scale left. Return the center readout dial to 0 upon completion of this step.

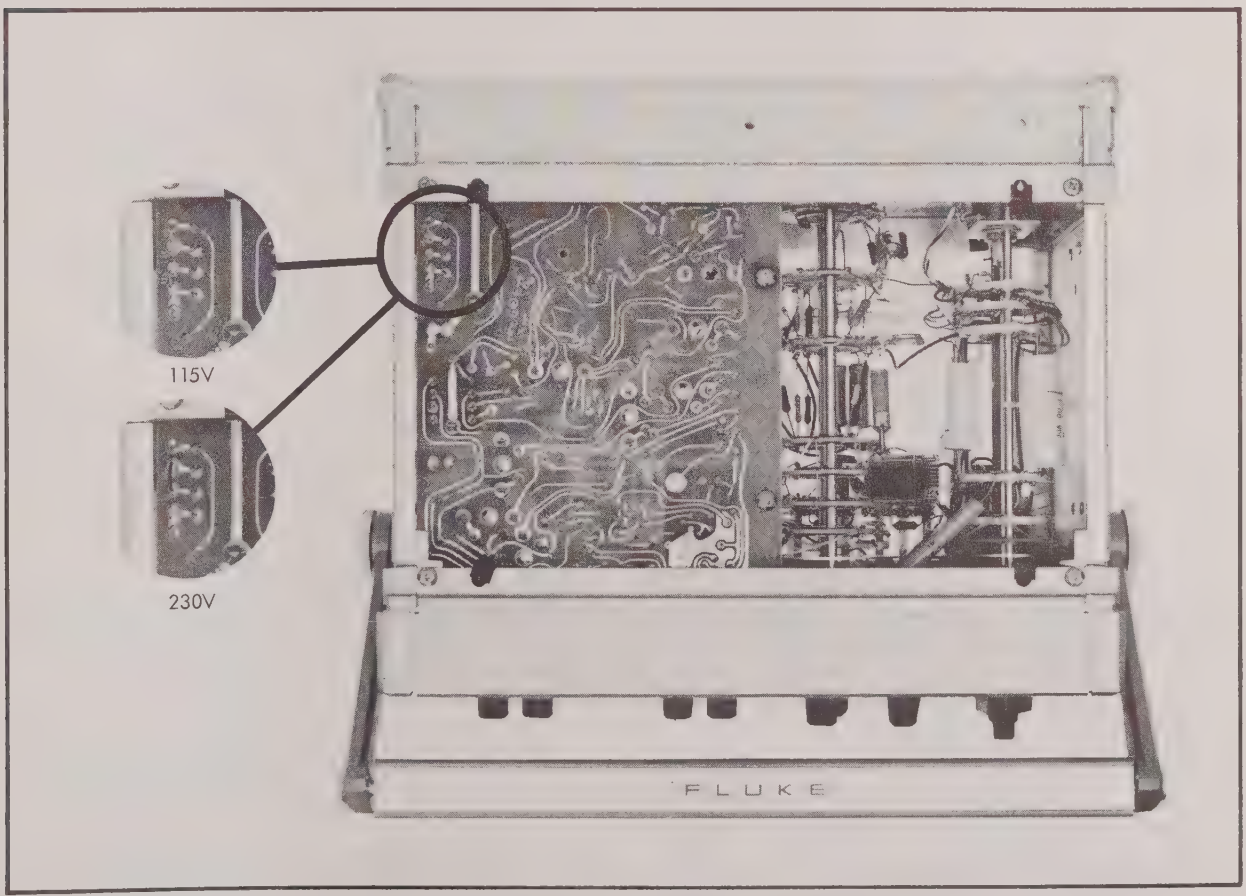


Figure 2-2. 115/230 VOLT AC POWER CONNECTIONS

d. Rotate the extreme left hand readout dial clockwise to each available position, observing that the meter deflects to full-scale left. Return the left hand readout dial to .0 upon completion of this step.

e. Place your finger tip in close proximity to the left + input terminal, observing that the meter increases its deflection to the right.

f. Place the RANGE switch to the 10M OHMS position and place the MODE switch to the +DC DIFF position. The meter should deflect to full-scale right.

g. Connect a shorting jumper across the left + and - input terminals, observing that the meter returns to center-zero.

h. Place the MODE switch to the +DC DIR position, observing that the meter indicates left-zero.

j. Remove the shorting jumper from across the + and - input terminals, observing that the meter deflects to full-scale right.

k. Place the MODE switch to the OFF position.

2-14. If the results of the Operational Test agree with the information given, it can be assumed the instrument is operating properly and measurements of voltage, current, or resistance may be performed.

2-15. OPERATION AS A DIRECT DC VOLTMETER OR AMMETER

2-16. The Model 853A can be used to make dc voltage or current measurements up to 1,000 volts or 10 amperes with an accuracy of ±2% of full-scale. To perform direct current or voltage measurements, proceed as follows:

a. Perform the preliminary operating procedures of paragraphs 2-9 and 2-10.

b. Place the Model 853A controls as follows:

MODE	+DC DIR
RANGE	1000 VOLTS or 1000 MA (The 10A position is used with an input to the 10 AMP input terminals only)

c. Connect the circuit to be measured to the left-hand INPUT terminals. For current measurements in excess of one ampere, connect the measured circuit to the right-hand (10 AMP) input terminals.

d. Place the MODE switch to the appropriate +DC DIR or -DC DIR position which produces a meter deflection from left to right.

e. Place the RANGE switch to the lowest voltage or current range possible while maintaining an on-scale meter deflection. The meter indication, multiplied by the RANGE switch position, is the value of the measured direct current or voltage.

2-17. OPERATION AS A DIFFERENTIAL DC VOLTMETER OR AMMETER

2-18. An improved accuracy of at least ten times over that of the direct dc mode is obtained when the Model 853A is used on the differential mode. To operate the instrument on the dc differential mode, proceed as follows:

a. Determine the approximate value and polarity of the measured voltage or current by performing the operations described in paragraph 2-16.

b. Place the readout dials to the meter deflection value of paragraph 2-16, step e.

c. Rotate the MODE switch one position clockwise to the DIFF position.

d. Rotate the NULL SENS control to maintain an on-scale meter deflection.

e. Rotate the readout dials for a center-zero meter indication while rotating the NULL SENS control to the HI (maximum clockwise) position.

f. The readout dials digit indication, multiplied by the RANGE switch position, is the value of the measured dc current or voltage.

2-19. OPERATION AS A DIRECT AC VOLTMETER OR AMMETER

2-20. The Model 853A can be used to make ac voltage or current measurements up to 1,000 volts or 10 amperes with an accuracy, from 20 Hz to 30 kHz, of ±2% of full-scale. To perform direct ac current or voltage measurements, proceed as follows:

a. Perform the preliminary operating procedures of paragraphs 2-9 and 2-10.

b. Place the Model 853A controls as follows:

MODE	AC DIR
RANGE	1000 VOLTS or 1000 MA position. (The 10A position is used with an input to the 10 AMP INPUT terminals only).

c. To prevent ground loop errors, it is recommended that the Model 853A be operated with the line cord disconnected (using battery power) or with a three prong to two prong line cord adaptor (floating the chassis from power line ground).

d. Connect the circuit to be measured to the left-hand INPUT terminals. For current measurements in excess of 1 ampere, connect the measured circuit to the right-hand (10 AMP) INPUT terminals.

e. Place the RANGE switch to the lowest voltage or current range possible while maintaining an on-scale meter deflection. The meter indication,

multiplied by the RANGE switch position, is the value of the measured ac current or voltage.

2-21. OPERATION AS A DIFFERENTIAL AC VOLTMETER OR AMMETER

2-22. An improved accuracy of at least five times over that of the direct ac mode is obtained when the Model 853A is used on the differential mode. To operate the instrument on the ac differential mode, proceed as follows:

a. Determine the approximate value of the measured voltage or current by performing the operations contained in paragraphs 2-20.

b. Place the readout dials to the meter deflection value of paragraph 2-20, step e.

c. Rotate the MODE switch clockwise to the AC DIFF position.

d. Rotate the NULL SENS control to achieve an on-scale meter deflection.

e. Rotate the readout dials for a center-zero meter indication while rotating the NULL SENS control toward the HI (maximum clockwise) position.

Note!

When the NULL SENS control is to the HI position, meter sensitivity is approximately 0.1% full-scale which may cause excessive meter noise to be observed. If excessive meter noise is observed, reduce the NULL SENS to about one per cent full-scale by rotating the vernier readout dial one per cent in either direction from the nulled value and adjust the NULL SENS control for a full-scale meter indication. The vernier readout dial is then readjusted for a center-zero meter indication.

f. The readout dial digit indication, multiplied by the RANGE switch position, is the value of the measured ac current or voltage.

2-23. OPERATION AS A DIRECT OHMMETER

2-24. The Model 853A can be used to make resistance measurements from zero to 100 megohms with an accuracy of ±3% of full-scale. To perform resistance measurements, proceed as follows:

a. Perform the preliminary operating procedures of paragraphs 2-9 and 2-10.

b. Place the Model 853A controls as follows:

MODE	+DC DIR
RANGE	OHMS (as desired)

c. Connect the circuit or the resistance to be measured to the left-hand INPUT terminals. If one side of the resistance is at a ground potential, that side should be connected to the negative (-) input terminal.

d. Place the RANGE control to the OHMS position that maintains an on-scale meter deflection. The meter indication multiplied by the RANGE switch position is the value of the measured resistance.

2-25. OPERATION AS A DIFFERENTIAL OHMMETER

2-26. An improved accuracy up to 15 times over that of the direct ohmmeter mode is obtained when the Model 853A is used on the differential ohmmeter mode. To operate the instrument as a differential ohmmeter, proceed as follows:

a. Determine the approximate value of the measured resistance by performing the operations contained in paragraph 2-24.

b. Place the readout dials to the meter deflection value of paragraph 2-24 step d.

c. Rotate the MODE switch to the +DC DIFF position.

d. Rotate the NULL SENS control to achieve an on-scale meter deflection.

e. Rotate the readout dials for a center-zero meter indication while rotating the NULL SENS control to the HI (maximum clockwise) position.

f. The readout dial digit indication, multiplied by the RANGE switch position, is the value of the measured resistance.

2-27. APPLICATIONS

2-28. INTRODUCTION

2-29. The Model 853A Multimeter because of its wide variety of measurement features can be used in many special applications. These applications, to mention a few, are; to measure voltage or current excursions about a nominal, as a null detector, to measure extremely high values of resistance, to test transistors, and as an output meter. The following applications are general in nature and may be further expanded upon as you become more familiar with your instrument.

2-30. MEASUREMENT OF VOLTAGE OR CURRENT EXCURSIONS ABOUT A NOMINAL VALUE.

2-31. The Model 853A can be used to measure voltage or current excursions about a nominal value when the instrument is used on the differential mode. The variable NULL SENS control allows calibration of the instrument's meter end-scale to be a percentage of the readout dials' digit value. This feature allows the meter end-scale to be calibrated from 0.1% to 4% of the measured voltage value or to be calibrated from 0.6% to 40% of the measured current value. To measure voltage or current excursions about a nominal value, proceed as follows:

a. Perform the preliminary operating procedures of paragraphs 2-9 and 2-10.

b. Determine the nominal value of the voltage or current being measured using the direct mode of the Model 853A. DC and AC direct measurement procedures as described in paragraphs 2-16 and 2-19, respectively.

c. Disconnect the measured circuit from the Model 853A input terminals.

d. Connect a shorting jumper across the input terminals and place the MODE switch to the desired differential mode.

e. Observing the position of the RANGE switch, place the readout dials to the desired percentage of nominal reading to be monitored and rotate the NULL SENS control for a zero-left meter indication.

f. The end-scale (left or right) indication of the meter is now calibrated to be the desired percentage of the nominal current or voltage. The meter scale divides the center-left or center-right meter deflection into 50 linear increments.

CAUTION!

Do not adjust the NULL SENS control from this point on or the meter end-scale will no longer be calibrated.

g. Disconnect the shorting jumper from across the input terminals and place the readout dials to the nominal value measured in step b.

h. Connect the measured circuit to the Model 853A input terminals. The voltage or current excursions about the nominal dialed value can now be determined by the left or right meter deflection from center-zero.

2-32. USE AS A NULL DETECTOR

2-33. The Model 853A, because of its high input impedance of 11 megohms on the dc differential voltage mode, can be used to monitor small voltage differences in bridge circuits, potentiometers, and other measuring devices. In most of these applications the circuits are adjusted for zero deflection or a null on the Model 853A. Equipment connections for two types of null detector configurations are illustrated in Figure 2-3 and 2-4. To operate the instrument as a null detector, perform the preliminary operating procedures described in paragraph 2-9 and 2-10 and proceed as follows:

a. Select the desired equipment applications as illustrated in Figure 2-3 and 2-4 and make the appropriate equipment connections.

b. Place the Model 853A controls as follows:

MODE	±DC DIFF
RANGE	1 VOLTS
NULL SENS	Maximum clockwise
Readout dials	.000

Note!

The instrument's line power cord must be disconnected if the instrument is used as a floating null detector.

c. Adjust the circuit being measured for zero (or a null deflection) on the Model 853A meter.

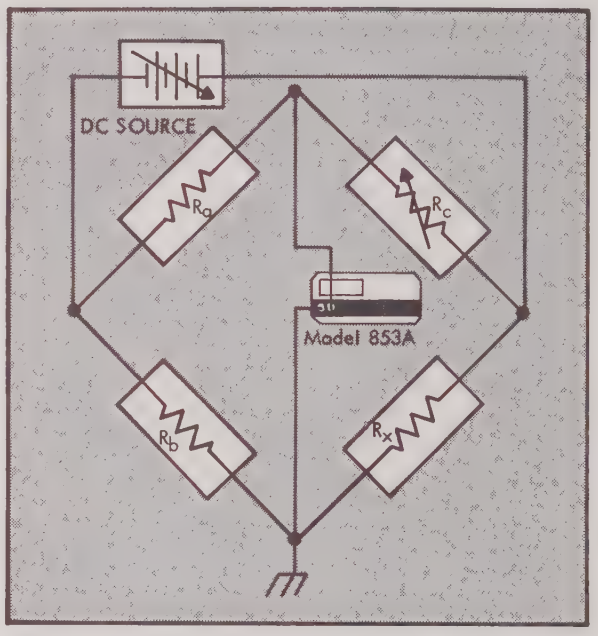


Figure 2-3. BRIDGE DETECTOR-FLOATING SUPPLY

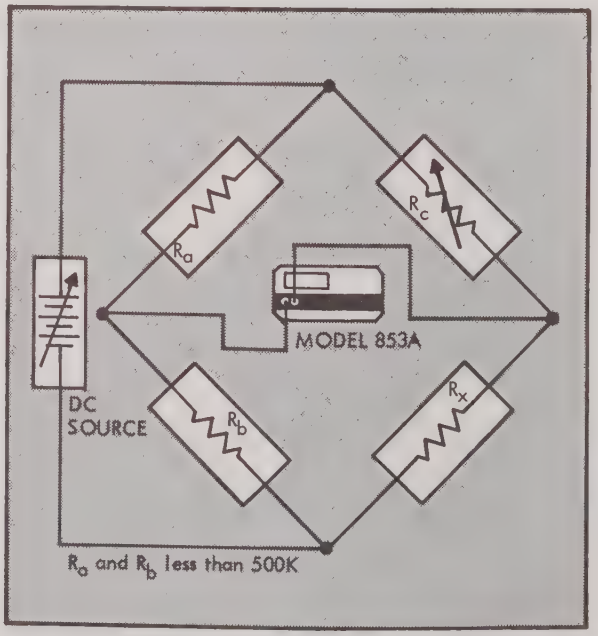


Figure 2-4. BRIDGE DETECTOR-FLOATING NULL DETECTOR

2-34. MEASUREMENT OF HIGH RESISTANCES

2-35. The Model 853A, when used with an external dc voltage, can be used to measure resistances in excess of 100 megohms. Equipment connections are illustrated in Figure 2-5. To determine resistance values in excess of 100 megohms perform the preliminary operating procedures described in paragraph 2-9 and 2-10 and proceed as follows:

a. Measure and record the external voltage supply potential using the + or - DC DIFF mode of the Model 853A.

b. Make the equipment connections illustrated in Figure 2-5.

c. Observe the voltage indicated on the Model 853A.

d. Using the following calculations determine the value of the unknown resistance.

$$R_x = \left(\frac{E_{bb}}{E_m} - 1\right) R_m$$

Where E_{bb} = External Applied Voltage

E_m = Model 853A Indicated Voltage of step c.

R_m = 11 Megohm (±0.1%)

Note!

The minus one may be dropped from the above formula when the ratio of E_{bb} to E_m is greater than 1000:1.

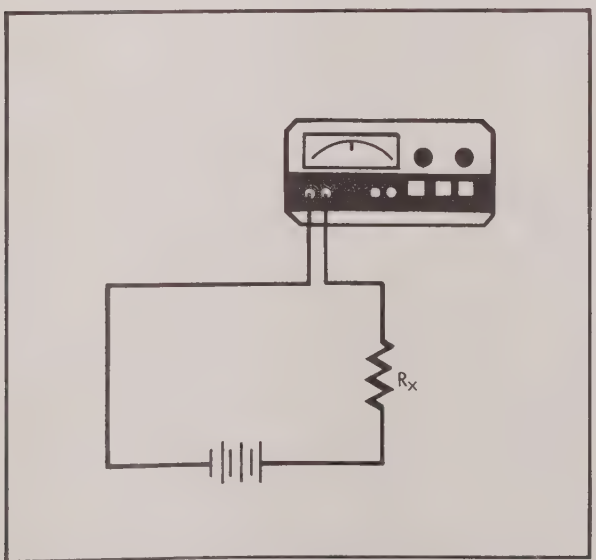


Figure 2-5. MEASUREMENT OF HIGH RESISTANCE - CIRCUIT CONNECTIONS

2-36. TESTING OF TRANSISTORS

2-37. The Model 853A Multimeter, when used on the DIR OHMS mode, produces a maximum current of one milliampere through the measured resistive circuit. Consequently, the instrument will not damage typical semi-conductor devices and may be used to safely test transistors. Forward and reverse junction resistance measurements of typical transistors are contained in Figure 2-6. In this application the instrument's positive and negative input terminals must be connected to respective base-emitter, base-collector, and collector-emitter junctions.

TRANSISTOR	MODEL 853A RANGE	BASE TO EMITTER	BASE TO COLLECTOR	COLLECTOR TO EMITTER
2N1303	10k	1.6k	1.6k	Inf
2N3565	100k	*68k	*63k	Inf
2N3638	100k	70k	66k	Inf
	* -DC DIR			

Figure 2-6. TRANSISTOR TESTING DATA

2-38. MEASUREMENT OF DBM

2-39. The Model 853A, when used with a 600-ohm load, can be used as an output meter. In this application the circuit to be measured must be terminated into a 600-ohm load and the Model 853A input terminals connected across the 600-ohm load. This is easily accomplished by connecting the 600-ohm load across the Model 853A left input terminals. The Model 853A is then operated on the direct or differential ac mode and the resulting meter deflection or readout dial indication converted to DBM using the information provided in Figure 2-7.

METER OR READOUT DIALS INDICATION	DBM LEVEL FOR 1 VOLT RANGE (1 mw into 600Ω)
.0138	-35
.1092	-17
.2182	-11
.3083	- 8
.4352	- 5
.5490	- 3
.6150	- 2
.6897	- 1
.7746	0
.8700	+1
.9760	+2
Add 20 db for each range above one volt.	

Figure 2-7. AC VOLTAGE TO DBM CONVERSION TABLE

2-40. OPERATING NOTES

2-41. MEASUREMENTS OF ISOLATED AC VOLTAGES OR CURRENT

2-42. When performing measurements of ac voltage or current having a reference other than ground, the Model 853A line cord must be disconnected from ac line power and the instrument operated on battery power. The Model 853A negative input terminal is connected to chassis ground through a 0.047 uf capacitor. This capacitor will place an ac load on the circuit being measured, if the Model 853A line cord is connected to line power, causing an inaccurate measurement to occur.

2-43. OVERLOAD PROTECTION

2-44. The Model 853A will withstand up to 1200 volts rms on any voltage range, current overloads up to 12 amperes on the 10A current range while all other current ranges are fused at two amperes. Fuse replacement instructions are contained in Section IV paragraphs 4-12 and 4-13. The instrument will also sustain voltage inputs on the ohmmeter mode up to 120 volts rms on all ranges to 10K and up to 230 volts rms on ranges above 10K. Should the instrument be subjected to prolonged overloads, excessive dissipation in the protective devices will result which cause generation of thermal voltages. These thermal voltages will take several minutes to subside after the overload is removed.

SECTION III

THEORY OF OPERATION

3-1. INTRODUCTION

3-2. The theory of operation for the Model 853A Multimeter is contained in this section of the manual. This instrument, because of its wide variety of measurement features, is best understood if each mode of operation is described individually. In doing so, the voltmeter, ammeter, and ohmmeter modes are described by block diagram analysis followed by a detailed circuit description of each block section and associated switching functions. Block diagrams for each modes of operation are illustrated in Figure 3-1 through 3-6 and functional schematic diagrams are located at the end of Section V.

3-3. BLOCK DIAGRAM ANALYSIS

3-4. INTRODUCTION

3-5. The Model 853A is composed of a voltage regulator/reference supply, a reference divider, a decade potentiometer, an input divider, current shunts, an ac-dc converter, a null detector amplifier, and a meter. Each of these circuits are interconnected by switching arrangements in various configurations when performing the desired voltage, current, or resistance measurements.

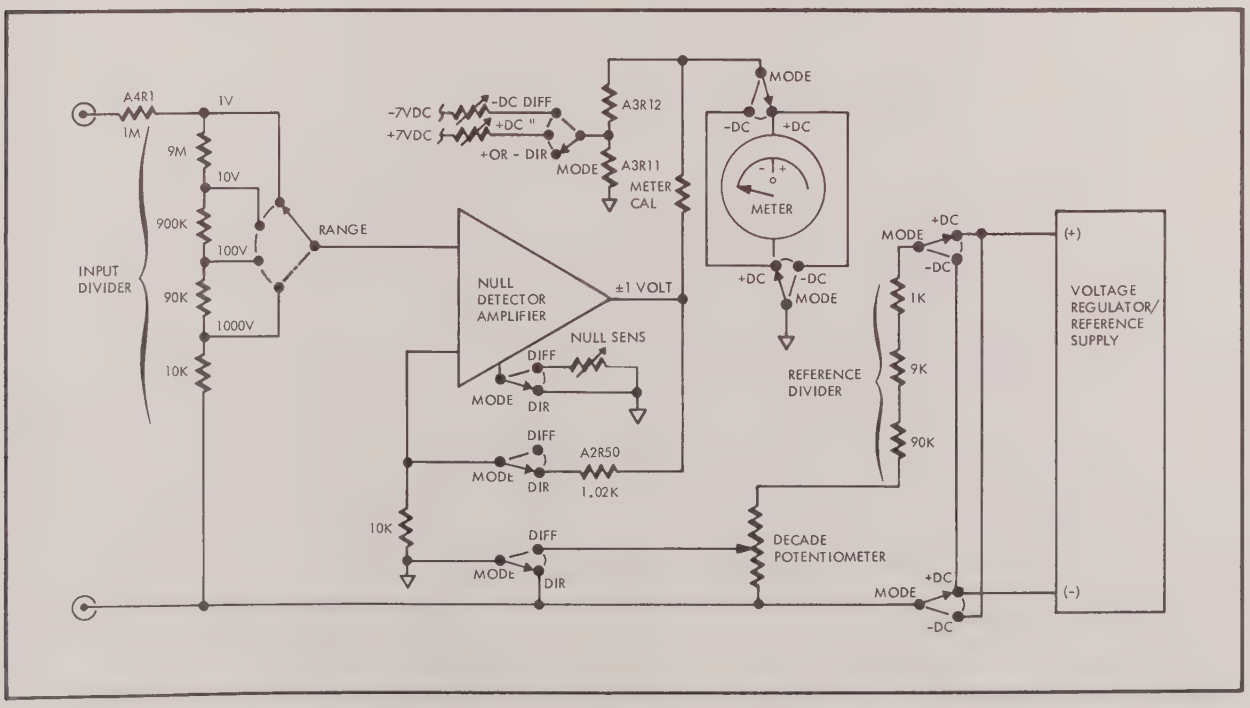


Figure 3-1. DC VOLTMETER BLOCK DIAGRAM

3-6. DC VOLTMETER MODES

3-7. When the Model 853A is used as a direct dc voltmeter, the circuitry of the instrument is connected as illustrated in Figure 3-1. The input divider resistors are connected across the input terminals of the instrument providing a constant 11 megohm input impedance on all ranges. In each position of the RANGE control, the selected tap of the input divider provides 0.9091 volts dc with a full-scale input voltage applied to the instrument. The resulting voltage from the input divider is applied to the null detector amplifier which drives the front panel meter. The gain of the null detector amplifier is precisely controlled by negative feedback feedback through A2R50 and produces a ± one volt dc output for a full-scale input to the instrument. For positive or negative voltage measurements the meter terminals are reversed through the contacts of the MODE switch.

3-8. By placing the MODE switch of Figure 3-1 to the DIFF positions, the block diagram of the Model 853A is connected as a dc differential voltmeter. In this application the MODE switch opens the null detector amplifier feedback, selects a potentiometer to control the null detector amplifier sensitivity, and selects a positive or negative reference voltage to center the meter pointer. Upon interruption of the null detector amplifier feedback, the low input side of the null detector amplifier is driven at the output voltage selected by the decade potentiometer, allowing the null detector amplifier to function as a null detector. The input divider voltage is then compared to the decade potentiometer output voltage by the null detector amplifier and any resulting difference used to drive the center-zero referenced meter pointer to the + right or - left indication. The + right or - left meter indications correspond to a decade potentiometer output level above or below the input divider level. Resolution of the differential measurements can be increased to approximately ±600 microvolts with the variable NULL SENS control which controls the null detector amplifier overall sensitivity. For positive or negative polarity measurements, the meter center-zero reference voltage, meter terminals, and the voltage regulator/reference supply polarity are reversed through the contacts of the MODE switch.

3-9. AC VOLTMETER MODES

3-10. When the Model 853A is used as a direct ac voltmeter, the circuitry of the instrument is connected as illustrated in Figure 3-2. The resistor A4R1 and the ac-dc converter are connected across the input terminals of the instrument providing a constant 1 megohm input impedance on all ranges. The ac-dc converter is an operational amplifier driving a half-wave detector whose overall gain is controlled by the negative feedback selected by the RANGE switch. With a full-scale ac input voltage applied to the instrument's input terminals, the ac-dc converter produces a dc output voltage of 0.9091 volts which is applied to the input of the null detector amplifier. The null detector amplifier, whose gain is precisely controlled by negative feedback through A3R20, drives the front panel meter which indicates the measured ac voltage.

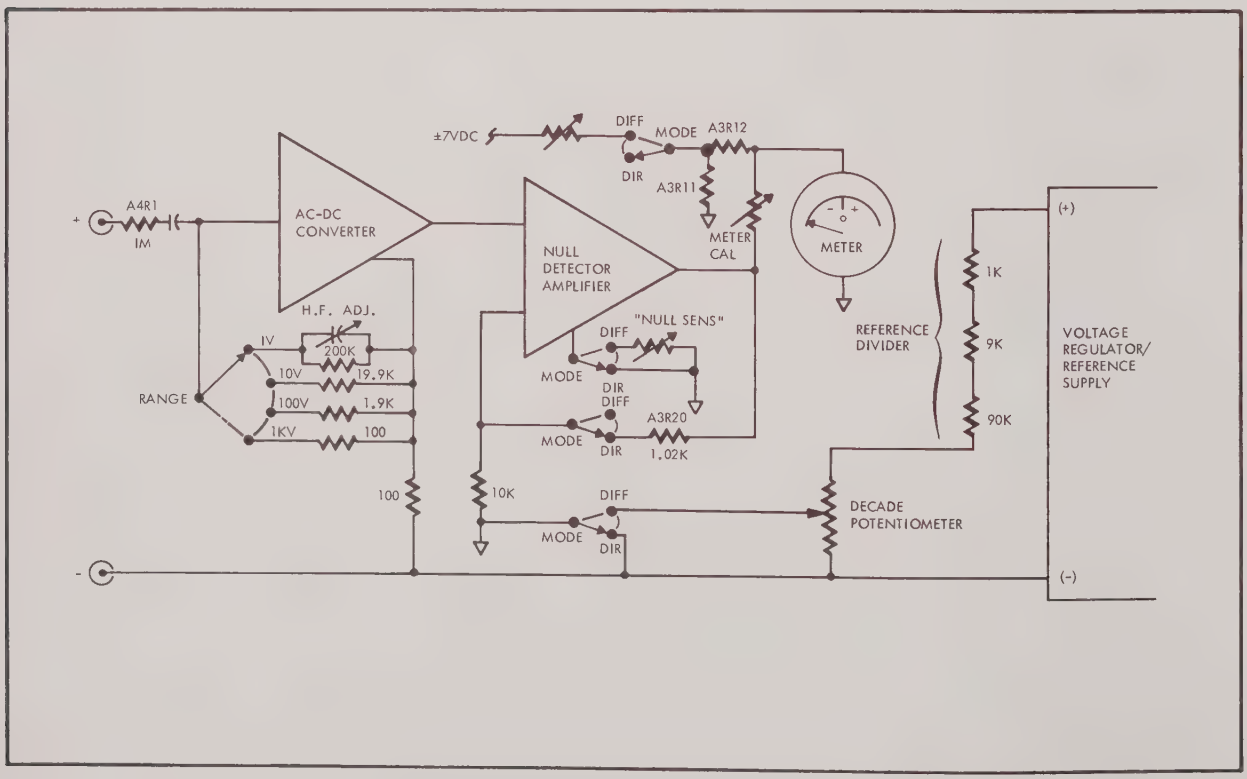


Figure 3-2. AC VOLTMETER BLOCK DIAGRAM

3-11. By placing the MODE switch of Figure 3-2 to the DIFF positions, the block diagram of Figure 3-2 is connected as an ac differential voltmeter. The ac-dc converter operates in the same manner as on the ac direct mode and supplies a full-scale input voltage of 0.9091 volts dc to the null detector amplifier. The remaining circuitry operates similar to the dc differential mode with the only difference being the absence of the polarity reversal switching.

3-12. DC AMMETER MODES

3-13. When the Model 853A is used as a direct or differential dc ammeter, the circuitry of the instrument is connected as illustrated in Figure 3-3. One of the six available shunt resistors is selected and placed across the input terminals of the instrument by the contacts of the RANGE switch. Full-scale current measurements produce a dc voltage of 100 millivolts across the selected shunt resistor which is applied to the input of the null detector amplifier. The null detector amplifier operates similar to the dc voltmeter modes described in paragraphs 3-7 and 3-8 except for the increase in gain brought about by increasing the value of the feedback resistor. This increase in gain of the null detector amplifier is necessary to compensate for the decrease in the full-scale input voltage from 0.9091 volts on the voltmeter modes to 100 millivolts on the ammeter mode. With only a full-scale input voltage of 100 millivolts available to the input of the null detector amplifier, the decade potentiometer output voltage must also be reduced on the ammeter modes. This is accomplished by the addition of two resistors to the reference divider which provide a full-scale output from the decade potentiometer of 111 millivolts, 11 millivolts for overranging. Current overloads are fused at two amperes on all ranges, except the 10A range, by the input fuse, while overload protection diodes prevent damage to the instrument circuitry from current overloads up to two amperes.

3-14. AC AMMETER MODES

3-15. When the Model 853A is used as a direct or differential ac ammeter, the circuitry of the instrument is connected as illustrated in Figure 3-4. The input circuitry is the same as used on the dc current modes and provides a full-scale ac input of 100 millivolts to the ac-dc converter. The gain of the ac-dc converter is such, that for a full-scale ac input, the ac-dc converter produces 0.9091 volts dc at the input of the null detector amplifier. Operation of the remaining circuitry is identical to the ac voltmeter modes described in paragraphs 3-10 and 3-11.

3-16. DIRECT OHMMETER MODE

3-17. The Model 853A circuitry, when used as a direct ohmmeter, is connected as illustrated in Figure 3-5. In this application a constant current is driven through the unknown resistance and the resulting voltage drop measured. Typical circuit connections are illustrated in the lower right-hand corner of Figure 3-5. The voltage regulator/reference supply output is connected across

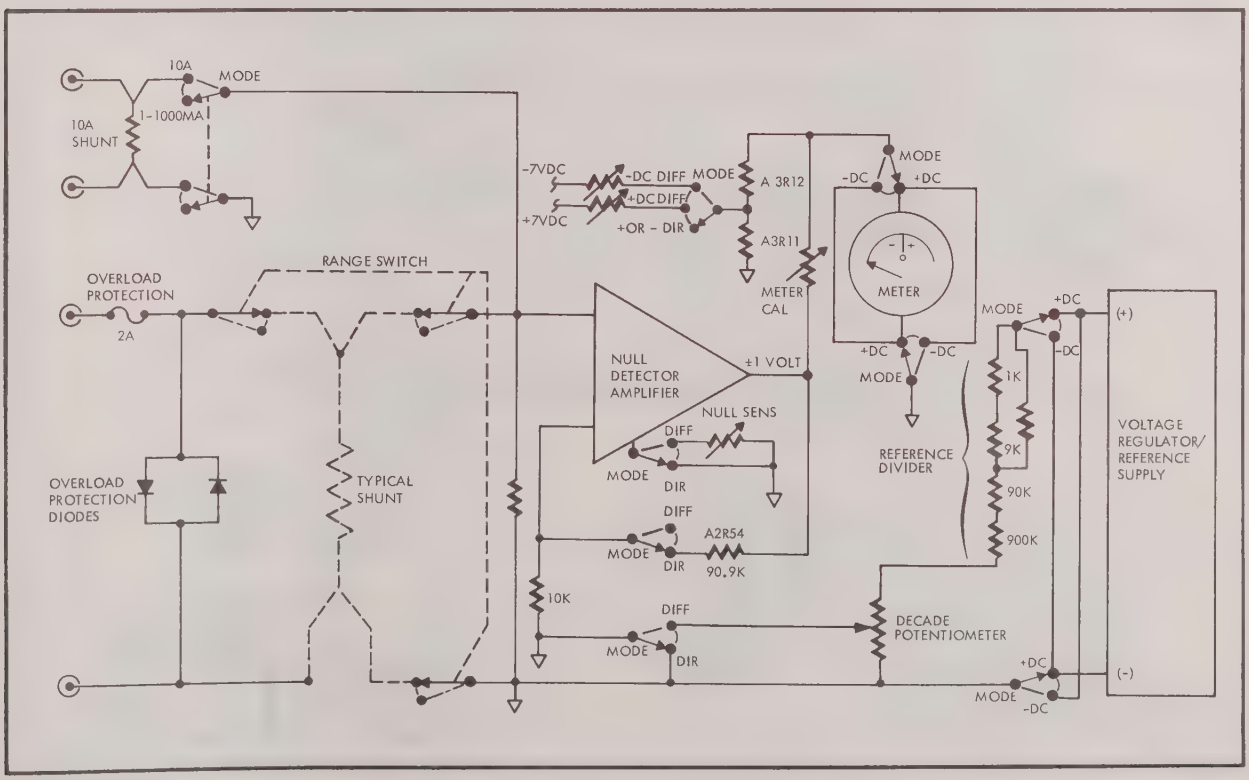


Figure 3-3. DC AMMETER BLOCK DIAGRAM

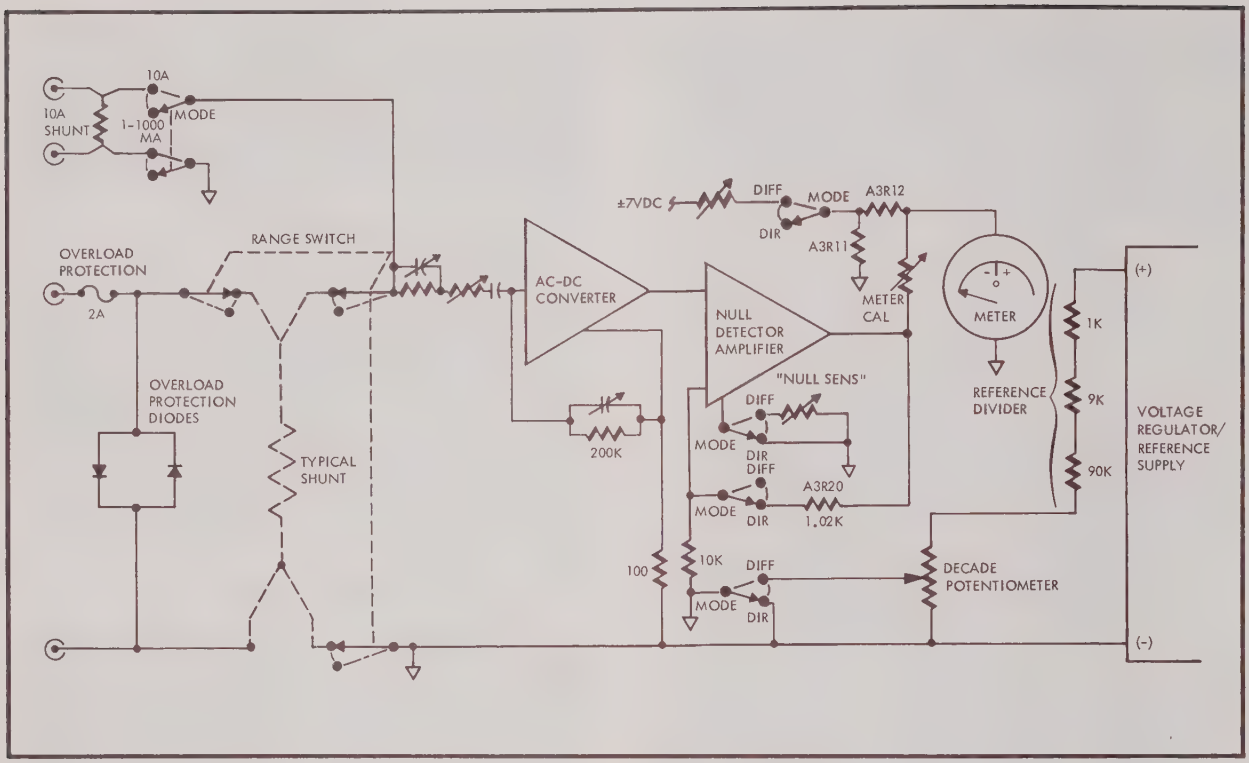


Figure 3-4. AC AMMETER BLOCK DIAGRAM

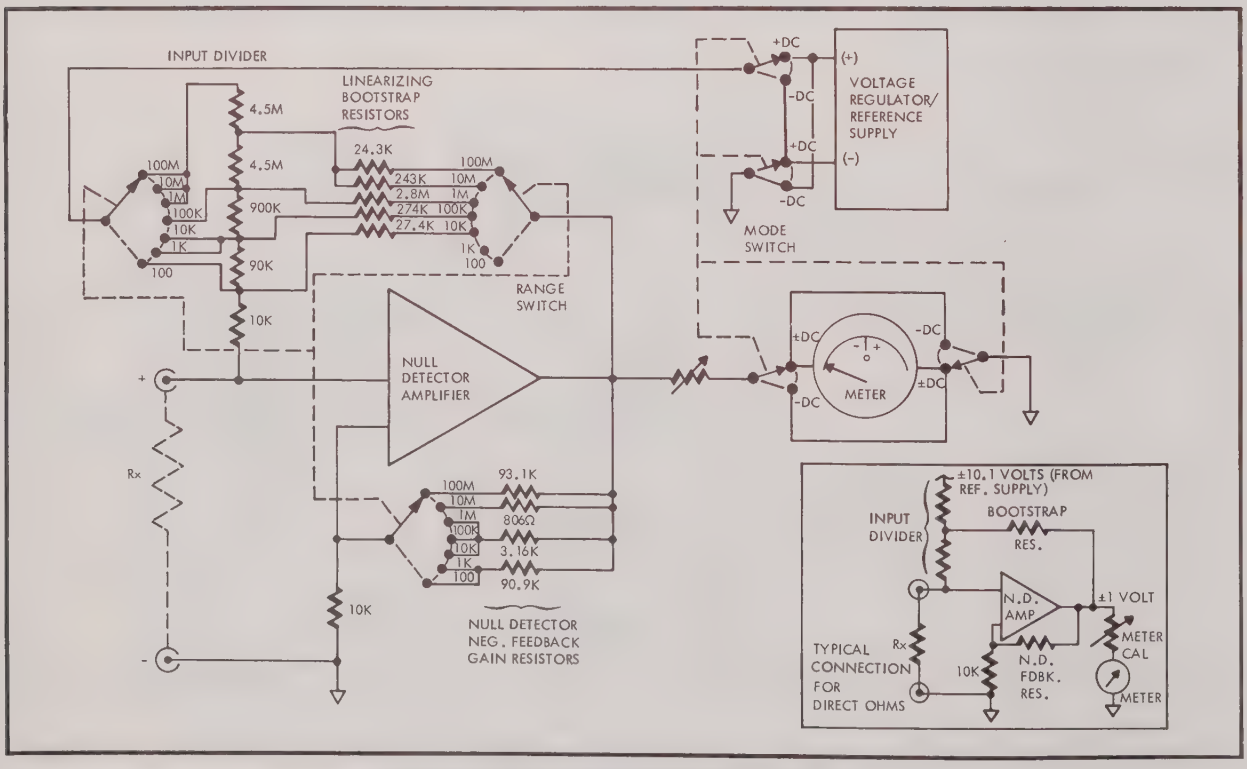


Figure 3-5. DIRECT OHMMETER BLOCK DIAGRAM

the unknown resistance and the input divider resistance selected by the contacts of the RANGE switch. This arrangement provides a constant current through the unknown resistance on ranges of 100 ohms and 1K. The resulting voltage drop across the unknown resistance is then amplified by the null detector amplifier, whose gain is controlled by negative feedback, and the resulting output voltage used to drive the linear scale meter. This meter indication, when multiplied by the RANGE switch position, indicates the unknown resistance value. On ranges above 1K the voltage regulator/reference supply can no longer supply a sufficiently linear current through the unknown resistance and the output of the null detector amplifier is bootstrapped through selected resistors to aid in providing a constant current through the unknown resistance. Polarity of the current source is reversed by switching the voltage regulator/reference supply output and meter terminals through the contacts of the MODE switch.

3-18. DIFFERENTIAL OHMMETER MODE

3-19. The Model 853A circuitry, when used as a differential ohmmeter is connected as illustrated in Figure 3-6. In this application the instrument is a Wheatstone Bridge with the decade potentiometer functioning as a precision rheostat in the R_y leg and the unknown resistance R_x as the other leg. A simplified circuit is illustrated in the lower right-hand corner of Figure 3-6. The input divider serves as ratio arm R_a and the reference divider as ratio arm R_b. The voltage regulator/reference supply provides bridge power and the null detector amplifier is connected across the opposite corners of the bridge to detect bridge balance. The RANGE switch selects the appropriate R_a/R_b resistance value for each range to match the full-scale decade potentiometer resistance of 10K ohms (11.1K ohms max. for 11% overranging). Polarity is reversed by switching the voltage regulator reference supply output across the bridge and reversing the meter terminals through the MODE switch contacts.

3-20. CIRCUIT DESCRIPTION

3-21. INTRODUCTION

3-22. The circuitry of the Model 853A is composed of a power supply/battery charger, a voltage regulator/reference supply, an inverter/isolator, a null detector, an ac-dc converter, a reference divider, a decade potentiometer, an input divider, current shunts, and a range and mode switch. Each of these circuits will be described in detail, using Schematic No. 1 (1 of 2) or (2 of 2). The switching information has been simplified for each mode in Schematics No. 2 through 4.

3-23. THE POWER SUPPLY/BATTERY CHARGER

3-24. Input power transformer A1T2 receives 115 or 230 volts ac through the contacts of the MODE switch S2-1a. The primary winding of A1T2 is constructed in such a manner as to allow the instrument to be operated from 115 volts ac, windings in parallel, or 230 volts ac, windings in series. Fuse A4F1 protects the Model 853A

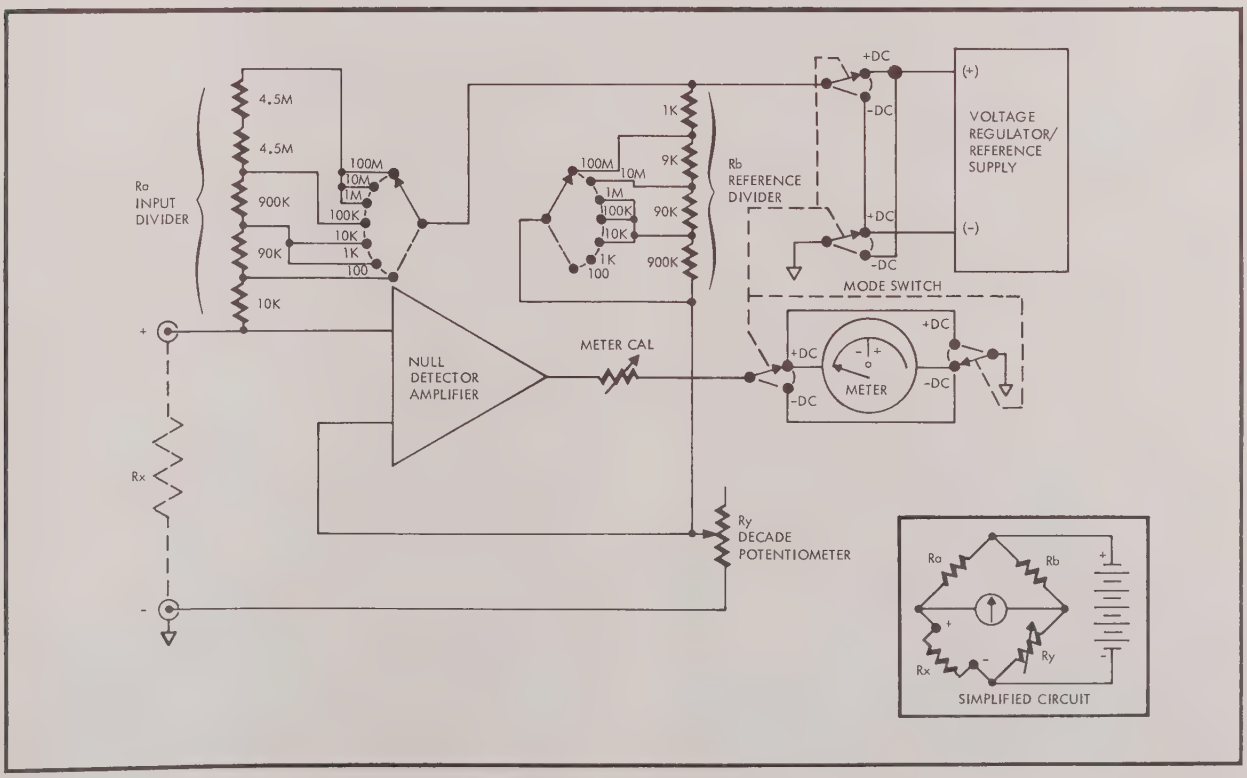


Figure 3-6. DIFFERENTIAL OHMMETER BLOCK DIAGRAM

circuitry from overloads. The secondary winding of A1T2 has two taps which supply ac voltages to the instrument's power supply and the battery charger. The ac voltage present at pin 7 of A1T2 is half-wave rectified by A1CR12 and A1C30. The resulting dc voltage is then applied to the input of the voltage regulator/reference supply. This same voltage also reverse biases the diode A1CR13, preventing discharge of the batteries when operating the instrument from line power.

3-25. The ac voltage present at pins 6 and 9 of A1T2 is full-wave rectified by A1CR10 and A1CR11 and used to charge the batteries of the Model 853A-01 version instruments. The lamp A4DS1 functions as a ballast, limiting the charge current to a non-destructive value while also providing a front-panel indication that the batteries are being charged. This lamp is not installed on the Model 853A versions of the instrument. Upon removal of ac power from the instrument, the diode A1CR13 is no longer reversed biased, allowing the battery voltage present at S2-3a to be applied to the input of the voltage regulator/reference supply. The resistor A1R63 limits surge currents when initially charging A1C30. Checking of the battery is obtained by placing the meter in series with the resistors A1R67 and A1R71 (A1R67 is used only on the Model 853A-01 versions) and then placing this network in parallel with the series pass transistor, A1Q22. The MODE switch S2-6e, S2-7d, and S2-7a provide the necessary switching functions, thus providing a check of the instrument's battery under an actual load condition.

3-26. THE VOLTAGE REGULATOR/REFERENCE SUPPLY

3-27. The unregulated dc voltage of the half-wave rectifier or the dc voltage of the battery, is applied to the input of the voltage regulator/reference supply. Transistor A1Q22 is the series pass element while resistor A1R66 provides starting current to initially turn-on the reference element of A1Q25. Transistor/zener A1Q25 forms the first stage of a comparison amplifier, with the zener providing a reference voltage. This reference voltage has a very low temperature coefficient from which the instrument derives its measurement stability. Resistor A1R70 provides additional zener current while A1R73 provides optimum bias for the transistor of A1Q25. The resistive network of A1R75, A1R76, A1R77, A1R78, and A1R80 form a divider across the output of the voltage regulator/reference supply and provides a sample of the output voltage to the base of the first stage of the comparison amplifier, A1Q25. Resistor A1R78 allows adjustment of the output voltage. Transistors A1Q23 and A1Q24, a differential pair, comprise the second stage of the comparison amplifier. Resistors A1R68 and A1R69 provide bias for the differential pair. The output of this differential pair controls the conduction of the series pass transistor A1Q22, which in turn determines the output voltage of the voltage regulator/reference supply.

3-28. To understand the regulator action, assume an increase in load resistance occurs causing an increase in the output voltage of the voltage regulator/reference supply. The resistive divider of A1R75 through A1R78 and A1R80 developes a corresponding voltage change at the base of transistor A1Q25. Since the emitter voltage of A1Q25 is held at the zener reference, the transistor A1Q25 increases conduction. This increase in conduction of A1Q25 decreases the conduction of A1Q24 which in turn increases the base voltage of the series-pass transistor A1Q22. The series-pass transistor A1Q22 is caused to decrease conduction by this action, retuning the output voltage to the nominal level.

3-29. THE INVERTER/ISOLATOR

3-30. The inverter/isolator provides dc operating voltages and synchronous drive voltages for the null detector amplifier circuitry free from any power line frequency variations and harmonics. The inverter/isolator circuitry is composed of a transformer-coupled multivibrator, comprised of A1Q20, A1Q21, A1T1, A1C22, A1R56 and A1R57, and three half-wave rectifiers, A1CR5 and A1C20, A1CR6 and A1C21, A1CR7 and A1C25. Transformer coupling allows the null detector amplifier to float relative to the rest of the instrument, providing electrical isolation of the null detector amplifier from the voltage regulator/reference supply.

3-31. Upon application of a 10.1 volt dc voltage, assuming that transistor A1Q20 will conduct harder than A1Q21, the collector of A1Q20 clamps the upper end of A1T1 at +10 volts dc. The other end of the transformer is driven to -10 volts by auto-transformer action. This causes the timing winding associated with A1Q22 to establish a voltage of less than +10 volts at the base of A1Q20 which drives the transistor into saturation. Capacitor A1C22 discharges through A1R57 holding transistor A1Q21 cut-off, further reinforcing the voltage polarities across A1T1. This action will continue, establishing the first half-cycle of the output square wave until A1C22 discharges sufficiently through A1R57 to allow A1Q21 to conduct. Upon the conduction of A1Q21, the collector of A1Q21 clamps the lower end of A1T1 at +10 volts causing the polarity across the timing winding and A1C22 to be reversed. Transistor A1Q20 is driven into cut-off while A1Q21 is driven into saturation by this action which establishes the second half-cycle of the output square-wave. This condition will persist until A1C22 discharges sufficiently through the timing winding of A1T1 and A1R56 to allow transistor A1Q20 to conduct, repeating the cycle. The resulting square-wave signal is then rectified by the half-wave rectifier of A1CR57 and A1C25 to provide the -10 volt dc operating voltage for the ac-dc converter and is also coupled to the secondary of A1T1. The secondary signal of A1T1 is used to provide the chopper and synchronous demodulator drive and the ±7 volt dc operating voltages for the null detector amplifier circuits. Diodes A1CR5 and A1CR6 along with A1C20 and A1C21 form the half-wave rectifiers used to produce the ±7 volt dc operating voltages.

3-32. THE NULL DETECTOR AMPLIFIER

3-33. The Null Detector Amplifier is a chopper stabilized dc amplifier using an insulated gate field effect transistor as a chopper. The circuitry is composed of a low pass filter A3R5, A1C10, A1R21, and R1C11, an overload protection device A1Q10, a chopper A1Q11, and A1R22, a chopper driver A1Q17, an ac coupled carrier amplifier composed of A1Q12 through A1Q15,

a synchronous demodulator A1Q16, an active output filter of A1R31, A1R35 and A1C18, and meter calibration resistors A1R32, A1R33, and A1R34.

3-34. Input voltages present at terminal 1 of the A1 printed circuit board are filtered by the low-pass filter comprised of A1C10, A1R21, and A1C11, reducing any normal mode noise interference. Zener A1Q10 provides overload protection, functioning as a normal diode for positive overloads and as a zener for negative overloads. Resistor A1R22 and MOS FET A1Q11 form the chopper which square-wave modulates the input voltage to the ac coupled carrier amplifier circuit. Transistor A1Q17 provides a square-wave signal to the gate of the MOS FET A1Q11 which is derived from the secondary of transformer A1T1. The collector signal of A1Q17 is reduced to a selected value by the resistive divider of A1R46, A1R58, and A1R59 and coupled by capacitor A1C14 to the output of A1Q11. This signal is 180° out-of-phase with the output modulating signal of A1Q11 and is used to null out any spikes generated internally in the MOS FET A1Q11. Capacitor A1C12 couples the resulting square-wave signal to the input of the ac coupled carrier amplifier. This signal, when the instrument is operated on the direct mode, is proportional to the difference between any feedback voltage present at terminal 4 and the input voltage at terminal 1 of A1. When the instrument is operated on the differential modes, terminal 4 is driven at the output level of the decade potentiometer, causing the resulting square-wave output of A1Q11 to be proportional to the difference between the input voltage of terminal 1 and the decade potentiometer's output level. This resulting square-wave signal is then amplified by the ac coupled carrier amplifier, composed of an emitter-coupled negative feedback tripleton of A1Q12 through A1Q14 and inverter amplifier A1Q15. When the instrument is operated on the differential modes, the NULL SENS control A3R15, which is connected to the common emitter resistor A1-R41, allows the ac coupled carrier amplifier gain to be varied for operator ease in locating a null. When the instrument is operated on the direct modes, the contacts of the MODE switch S2-6C connect terminal 2 of A1 to null detector common, providing maximum gain for the ac coupled carrier amplifier, independent of the NULL SENS control. Transistor A1Q15 functions as an inverter, developing the ac coupled carrier amplifier output across A1R43. Bias stability for the ac coupled carrier amplifier is obtained by feeding back a portion of the emitter voltage of A1Q15 to the base of A1Q12 through A1R30, A1R44, and A1R45. The collector signal of A1Q15 is coupled by capacitor A1C16 to the synchronous demodulator A1Q16. The synchronous demodulator A1Q16 is driven in synchronism with the chopper A1Q11 by the signal applied through A1R54 from the secondary of A1T1 and is operated in the inverse mode to secure minimum saturation voltage. The resulting demodulated dc signal is filtered by the low-pass filter composed of A1R35 and A1C18 and applied to terminal 6 and A1R34. To reduce any signal at the chopper frequency from appearing on this line, an out-of-phase signal from the emitter of A1Q15 is coupled by A1C17 and A1R31 to A1C18, forming an active filter for the output. The voltage present at terminal 6 of A1 is used on the direct modes of operation for negative feedback, while the voltage applied through A1R34 is used to drive the meter M1. Meter calibration is accomplished with A1R34, while variable resistors A1R32 and A1R33 provide approximately 50 microamperes of current to center-zero the meter on the differential mode.

3-35. THE AC-DC CONVERTER

3-36. The AC-DC Converter is an operational amplifier driving a half-wave detector. The operational amplifier is composed of a high-gain amplifier A1Q1 through A1-Q3, a constant current source A1Q5, a dynamic load A1Q4, selected feedback resistors A2R22 through A2R25 which determine the ac gain with high precision, and half-wave detector A1CR2 and its associated circuitry.

3-37. Ac input signals present at terminal 16 of A1 are amplified by transistors A1Q1 through A1Q3. Feedback from the emitter of A1Q3 to A1Q1 through A1R8 and A1-C3 controls overall gain of the amplifier. Transistor A1Q5 provides a constant current from the -10 volts dc produced by the half-wave rectifier of A1CR7 and A1C25 in the inverter/isolator. Capacitor A1C3 and A1C2 determine the respective upper and lower 3 db cut-off frequencies of the amplifier. The output of A1Q3 is applied to the dynamic load A1R4, A1R5, A1R6, A1C4, and A1Q4 which presents a low dc resistance and a high midband resistance to the output of A1Q3. This is necessary because of the low supply voltage used in this instrument and allows the amplifier to have the output characteristics of a constant current source. The output signal coupled through A1C5 drives the diodes A1-CR1 and A1CR2 through their cross-over region very rapidly, producing very low cross-over distortion in the signal developed across A1R18. The signal developed across A1R18 is fed back to the input of the AC-DC Converter through the resistance selected by the contacts of S1-8, and causes a current directly proportional to the input ac voltage to flow through the diodes A1CR1 and A1CR2. The resulting dc voltage detected by A1CR2 is developed across A1R14, A1R16, and A1R17 and applied through A1R15 to terminal 15 of A1. This positive dc voltage is filtered by A1R15 and A3C5, and applied to the input of the null detector amplifier on the ac modes by the MODE switch S2. Calibration of the ac voltage ranges is accomplished with A1R17 and the chassis mounted component A2C5, while the ac current ranges are calibrated with the chassis mounted A2R21 and A2C1. Resistor A2R26 is switched into the input of the AC-DC Converter on ac voltage ranges above one volt to prevent oscillations.

3-38. THE REFERENCE DIVIDER

3-39. The Reference Divider is composed of five precision resistors A2R40 through A2R44 and is used to reduce the voltage regulator/reference supply voltage to the desired full-scale voltage requirement of the decade potentiometer. These resistors are matched to each other within ±200 ppm. The instrument's MODE and RANGE switches select the desired resistor combinations to provide an input voltage to the decade potentiometer of 111 millivolts on the dc current mode and 1.0101 volts on the dc voltage and both ac modes. When the instrument is operated as a differential ohmmeter, the MODE and RANGE switches select the desired resistance value of the Reference Divider that is

to be placed in series with the decade potentiometer to form one leg of a Wheatstone Bridge.

3-40. THE DECADE POTENTIOMETER

3-41. The Decade Potentiometer is composed of S3 and its associated 2K resistors, S4 and its associated 200 ohm resistors, and potentiometer A4R10. The Decade Potentiometer is a constant resistance divider commonly referred to as a "put-and-take" divider. The resistance of the divider is 11.1K, providing a maximum front panel readout dial setting of 1.1100. Input voltages to the divider are reduced to the desired output level by the manipulation of the switches S3 or S4 and vernier control A4R10. The resulting output voltage is then applied to the null detector amplifier through the contacts of the MODE switches on the ac and dc differential modes, allowing the null detector amplifier to function as a null detector. When the instrument is operated on the differential ohmmeter mode, one end of the Decade Potentiometer is shorted to its output tap by the contacts of the RANGE switch, thus allowing the Decade Potentiometer to be used as a rheostat in one leg of a Wheatstone Bridge.

3-42. THE INPUT DIVIDER

3-43. The Input Divider is composed of five series connected resistors A2R1 through A2R5. Total resistance of the divider is 10 megohms and the resistors are matched to each other within ±200 ppm. Input voltages to the instrument on the dc voltmeter modes are reduced to approximately one volt full-scale at each tap selected by the RANGE switch allowing the input impedance of the instrument to remain constant. When the instrument is operated on the respective direct or differential ohmmeter modes, the Input Divider serves as part of the bootstrapped current source or one leg of a Wheatstone Bridge.

3-44. THE CURRENT SHUNTS

3-45. The Current Shunts consist of five low inductance resistors A2R30 through A2R34 matched to within ±200 ppm and a separate 10 ampere shunt A4R5 which can be calibrated with A1R60. Resistors A2R30 through A2R32 and A4R5 are true four-terminal resistors used to prevent the voltage drop across their leads from affecting measurement accuracies. The voltage developed across the selected shunt resistor, at a full-scale ac or dc current measurement, is 100 millivolts which is then applied, depending on the mode of operation, through the MODE switch to the input of the ac-dc converter or the null detector amplifier.

3-46. THE RANGE AND MODE SWITCHES

3-47. The Range and Mode switches used in the Model 853A allow the instrument to be used to measure voltage, current, or resistance over a wide measurement range. The Range switch S1 is a rotary, 18 position, eight deck, multiple pole switch, and the Mode switch S2 is a rotary, eight position, seven deck, multiple pole switch. No attempt will be made to describe each and every switch pole function as schematic diagrams for each mode of operation showing the associated switch functions are contained at the end of Section VI..

SECTION IV

MAINTENANCE

4-1. INTRODUCTION

4-2. This section of the manual contains the information necessary for you to completely maintain your Model 853A Multimeter. The information is arranged under headings of "SERVICE INFORMATION, GENERAL MAINTENANCE, PRECALIBRATION AND TROUBLESHOOTING, and CALIBRATION PROCEDURES." A list of the test equipment required for maintenance of this instrument is contained in Figure 4-1. If the recommended test equipment is not available, other instruments having the equivalent specifications may be substituted.

4-3. Your instrument was completely tested and aligned before leaving the factory and calibration should not be necessary during the first year of operation. However, should you wish to check the instrument's accuracy against the specifications contained in Section I, the information contained in the Calibration Procedures may be used. The Calibration Procedures are arranged in such a manner that, by disregarding the adjustment information, they may be used as Instrument Performance Checks.

4-4. We recommend that you thoroughly read and understand this section of the manual before attempting any maintenance on the Model 853A Multimeter.

4-5. SERVICE INFORMATION

4-6. Each instrument manufactured by the John Fluke Mfg. Co., Inc. is warranted for a period of one year upon delivery to the original purchaser. Complete warranty information is contained in the Warranty page located at the rear of this manual.

4-7. Factory authorized calibration and repair service for all Fluke instruments are available at various world wide locations. A complete list of factory authorized service centers is located at the rear of the manual. If requested, an estimate will be provided to the customer before any repair work is begun on instruments beyond the warranty period.

4-8. GENERAL MAINTENANCE

4-9. PERIODIC CLEANING

4-10. The Model 853A Multimeter is completely enclosed, therefore no entry for dust, dirt, or lint is provided. Consequently, it is usually only necessary to clean the exterior surfaces of the instrument. To clean the exterior, use a cloth moistened with anhydrous ethyl alcohol or Freon T. F. Degreaser, MS 180 Miller - Stephenson Chemical Co., Inc.

4-11. If it becomes necessary to clean the interior of the instrument, the switches may be cleaned using clean dry air at a pressure of 15 pounds or less and the printed circuit board may be cleaned by spraying with Freon T. F. Degreaser. The switch assemblies must be wrapped with a protective covering when spraying the printed circuit board with Freon T. F. Degreaser or contamination of the switches will occur.

CAUTION!

Do not use solvents, containing keytones since dielectric materials used in the instrument may be damaged.

4-12. REPLACEMENT OF FUSES

4-13. There are two fuses used in the Model 853A Multimeter. Input power to the instrument is fused at 1/16A by A4F1 located in a bayonet fuseholder mounted on the rear panel assembly of the instrument. When replacing A4F1, use a 1/16A, slow blow, type MDL fuse. Current overloads in excess of 2 amperes, on current ranges of 1000 MA and below, are prevented from damaging the instrument's circuitry by A2F1. This fuse is mounted between the first and fourth deck of the RANGE switch on early versions of the instrument. On later versions of the instrument, A2F1 has been redesignated A4F2 and is located in a clip-holder mounted on the switch shield adjacent to the RANGE switch. Refer to Figure 4-2 for location of A2F1. When replacing the clip-holder-mounted fuse, remove the bottom cover of the instrument and replace the

EQUIPMENT	SPECIFICATIONS	RECOMMENDED EQUIPMENT
AC Power Source	Output voltage up to 500 VAC. Output current up to 2 amps. Frequency range of 20 Hz to 30 kHz having an amplitude stability of 0.1%.	Optimation Model AC101A Krohn-Hite LDS 500
AC-DC Differential Voltmeter	Frequency range to 30 kHz with an accuracy of 0.1% of reading	Fluke Model 887A
Transfer Standard	AC to dc transfer accuracy of ±0.05%, 20 to 30 kHz, at voltages of 1 to 500 VAC and currents to 2 amperes.	Fluke Model 540B
Current Shunts	Frequency range to 30 kHz having a dc to ac difference of 0.05%.	Fluke A40 Shunts 20 ma, 100 ma, 1a, and 5 ampere
Current Transfer Switch	AC to DC comparison switch.	Fluke Model A45
DC Current Source	0 to 2 amperes having an accuracy of 0.02%.	Fluke Model 382A
DC Voltage Source	0 to 1000 VDC having an accuracy of 0.02%.	Fluke Model 332B Fluke Model 335A
Oscilloscope	Sweep range: 50 usec/cm to 1 msec/cm. Sensitivity 50 mv/cm.	Tektronix Model 504
Auto Transformer	0- 140 volts ac at 1 amp.	General Radio Model W5MT
AC Ammeter	0- 100 ma.	Fluke Model 853A
Decade Resistor Box	Accuracy of 0.05% up to 10 Megohms.	ESI Model 1063
Resistance Source	5 Megohms to 100 Megohms having an accuracy of 0.1%.	ESI Model SR1050

Figure 4-1. REQUIRED TEST EQUIPMENT

fuse with a 3AG, 2 ampere fuse. To replace the early version RANGE-switch-mounted-fuse, proceed as follows:

a. Remove the bottom cover of the instrument.

b. Locate the fuse connected between the first and fourth deck of the RANGE switch.

c. Cut the leads at each end of the fuse and remove the fuse. Replace with a 3AG, 2 ampere, pigtail fuse by soldering the replacement fuse leads to the existing leads.

d. Replace the bottom cover of the instrument.

4-14. BATTERY REPLACEMENT

4-15. Battery replacement is necessary after extended use on the carbon battery, or upon failure of one or more of the nickel-cadmium cells. To replace the battery pack, proceed as follows:

a. Remove the four screws that attach the bottom dust cover to the instrument and remove the bottom dust cover from the instrument.

b. Locate the battery pack on the rear panel assembly. Disconnect the red and black battery pack wires from the printed circuit board terminals.

c. Remove the rear panel screws that secure the battery pack to the rear panel assembly and remove

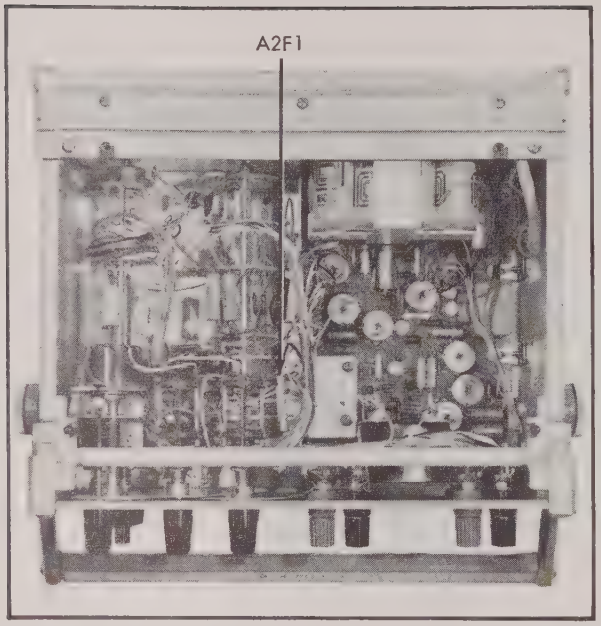


Figure 4-2. LOCATION OF A2F1

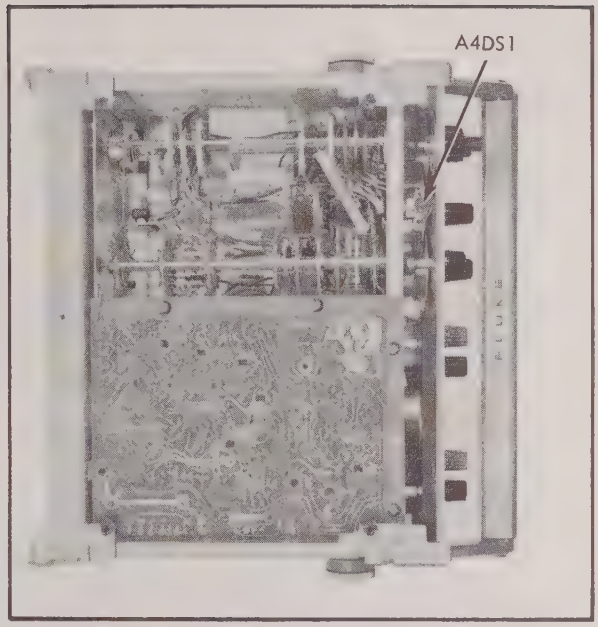


Figure 4-3. LOCATION OF A4DS1

the battery pack from the instrument. If your instrument contains carbon batteries, perform steps d, and g through i of the following procedure. If your instrument contains rechargeable batteries, perform step e through i of the following procedure.

d. Replace the carbon battery pack with a new carbon battery pack using an Eveready 763 or equivalent, and secure it to the rear panel assembly with the screws removed in step c.

e. Locate the defective cell or cells in the rechargeable battery pack. Replace the cell or cells with an identical nickel-cadmium cell, Fluke part number 4002-160390. Observe proper polarity of connections when replacing nickel-cadmium cells.

f. Replace the rechargeable battery pack by securing it to the rear panel assembly with the screws removed in step c.

g. Connect the red and black battery pack wires to the printed circuit board terminals.

h. Replace the bottom cover and secure it to the instrument with the screws removed in step a.

i. Check the batteries as outlined in Section II, paragraph 2-9 and 2-10.

4-16. BAT CHG LAMP REPLACEMENT

4-17. The Model 853A-01 version instruments contain a BAT CHG lamp A4DS1 mounted behind the front panel. Refer to Figure 4-3 for location. When replacement of A4DS1 becomes necessary, remove the upper dust cover and front panel trim strip from the instrument to gain access to the lamp. Remove A4DS1 and replace with a duplicate GE#1820 bulb.

4-18. PRECALIBRATION AND TROUBLESHOOTING

4-19. INTRODUCTION

4-20. Before attempting to calibrate the Model 853A Multimeter, a parameter check of the major sections of the instrument's circuitry should be performed. These precalibration checks, when the desired results are obtained, will ensure that each major portion of the instrument is contributing the least possible error toward overall instrument inaccuracy. When performing these checks it may become necessary to replace component parts in order to obtain the desired results. Under these circumstances, general troubleshooting of the circuitry is necessary. As each malfunction is corrected, a complete recheck of the circuitry involved is also necessary.

4-21. The following tests should be performed in a draft free area and at an ambient temperature of 68° - 80° F. Adjustments and test point locations are illustrated in Figure 4-4. At the beginning of each check the type of test equipment is given. Refer to Figure 4-1 for the recommended test equipment.

4-22. VOLTAGE REGULATOR/REFERENCE SUPPLY CHECKS

4-23. The Voltage Regulator/Reference Supply Checks require an auto-transformer, an ac ammeter and a dc differential voltmeter. Nominal transistor voltages are contained in Figure 4-6. To perform the checks, proceed as follows:

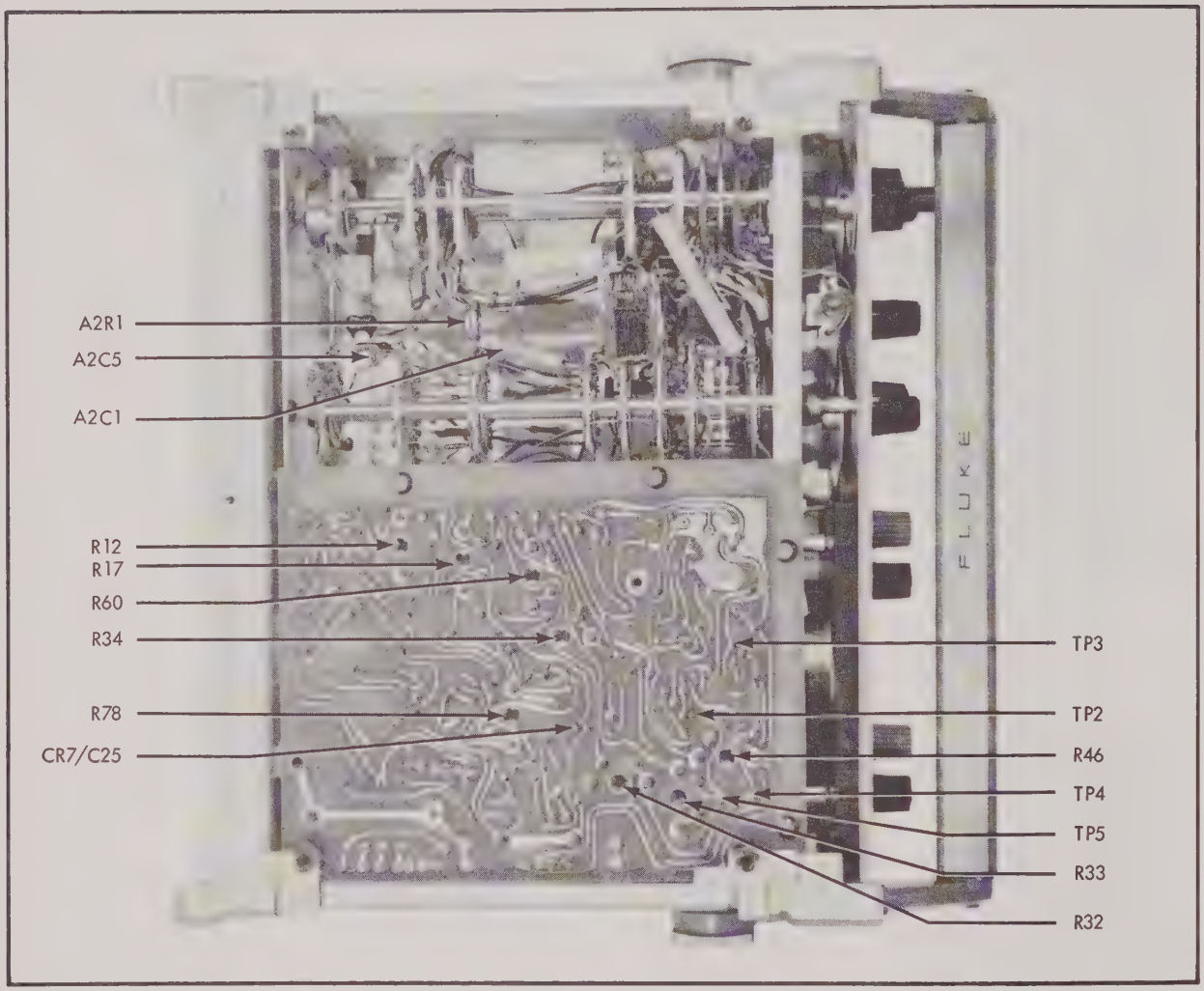


Figure 4-4. ADJUSTMENTS AND TEST POINTS

a. Remove the upper and lower dust covers and upper trim strips from the instrument. The covers and trim strips will remain off for the remainder of the checks.

b. Make the equipment connections illustrated in Figure 4-5 and place the Model 853A controls as follows:

MODE	+ DC DIFF
RANGE	100M OHMS
Readout dials	.000

c. Disconnect the wire connected to terminal 21 of the printed circuit board, taking care to avoid contact with adjacent wires and chassis.

d. Apply 115 volts ac, 60 Hz, through the auto-transformer to the Model 853A. The ac ammeter should indicate less than 30 milliamperes for the Model 853A and less than 60 milliamperes for the Model 853A-01.

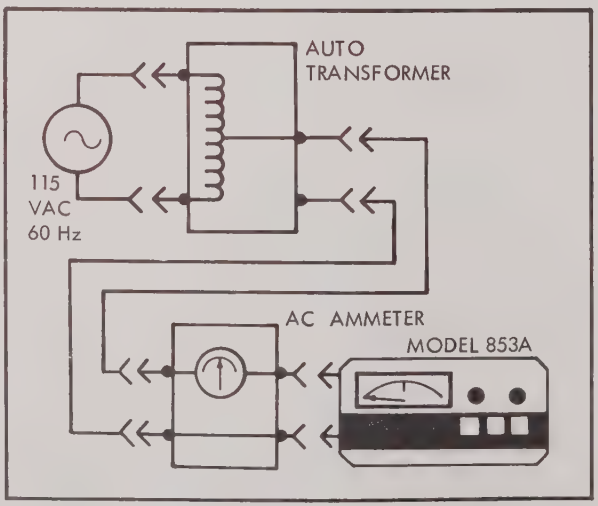


Figure 4-5. REGULATION TEST-EQUIPMENT CONNECTIONS

e. Connect the input of a dc differential voltmeter to terminal 14 of the printed circuit board and connect the common lead to terminal 13. The voltmeter should indicate +10.1 (±0.017) volts dc. Record this voltage for future reference.

f. Rotate R78 to each available limit, observing that the dc voltage indicated on the differential voltmeter changes by at least 0.06 volts.

g. Adjust R78 for the dc voltage initially observed in step d.

h. Decrease the ac input voltage applied to the Model 853A to 75 volts ac with the auto-transformer control. The voltage observed on the dc differential voltmeter should not decrease more than five millivolts.

i. Place the RANGE switch to 1 VOLTS and increase the ac input voltage applied to the Model 853A to 125 volts ac with the auto-transformer control. The voltage observed on the dc differential voltmeter should not increase more than six millivolts.

j. Remove ac power from the Model 853A and reconnect the wire removed in step c to terminal 21 of the printed circuit board.

k. Reapply 115 volts ac to the Model 853A.

4-24. When the results of these checks agree with the information given, the voltage regulator/reference supply is functioning properly and the dc differential voltmeter can be disconnected from the Model 853A.

TRANSISTOR	EMITTER	BASE	COLLECTOR
Q22	+28.7v	+28.1	+10.1
Q23	+ 7.1v	+ 7.65	+10.1
Q24	+ 7.1v	+ 7.65	+28.0
Q25	* 6.2v	6.8v	+ 7.65

* R70-Zener Reference
All voltages ±20%

Figure 4-6. VOLTAGE REGULATOR/REFERENCE SUPPLY TRANSISTOR VOLTAGES

4-25. INVERTER/ISOLATOR CHECKS

4-26. The Inverter/Isolator Checks require a dc differential voltmeter and an oscilloscope. Nominal transistor voltages and waveforms are illustrated in Figure 4-7. To perform the checks, proceed as follows:

a. Connect the signal input of an oscilloscope to the collector of Q20 and the ground lead to terminal 13 of the printed circuit board.

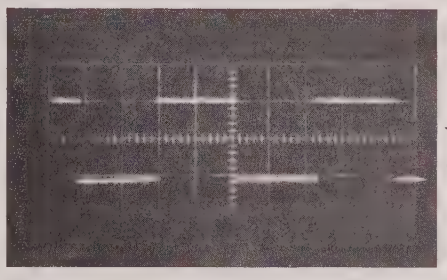
b. The peak-to-peak amplitude of the waveform observed on the oscilloscope CRT should be 20 (±0.5) volts at a frequency of 190 to 240 Hz.

c. Disconnect the oscilloscope input from the Model 853A.

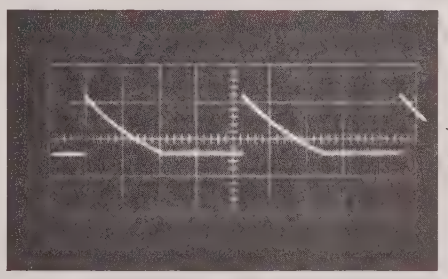
d. Connect the dc differential voltmeter input to the junction of CR7 and C25 on the printed circuit board and connect the common lead to terminal 13 of the printed circuit board.

e. The dc differential voltmeter should indicate -9.4 (±0.3) volts dc.

4-27. When the results of these checks agree with the information given, the Inverter/Isolator is functioning properly and the dc differential voltmeter can be disconnected from the Model 853A.



Collector Q20 or Q21 1 msec/cm



Q20 and Q21 Base 1 msec/cm

TRANSISTOR	EMITTER	BASE	COLLECTOR
Q20	+10.1	+16.0	0
Q21	+10.1	+16.0	0

* All waveforms taken with an ac coupled oscilloscope

All voltages ±20%

Figure 4-7. INVERTER/ISOLATOR TRANSISTOR VOLTAGES AND WAVEFORMS

4-28. AC-DC CONVERTER CHECKS

4-29. The AC-DC Converter Checks require an ac power source, and an ac-dc differential voltmeter. Nominal transistor voltages and waveforms are illustrated in Figure 4-10. To perform the checks, proceed as follows:

a. Place the Model 853A controls as follows:

MODE	AC DIR
RANGE	10 V

b. Connect the input of the dc differential voltmeter to TP1 and the common lead to terminal 13 of the Model 853A printed circuit board. The voltage observed on the differential voltmeter should be +0.85 volts dc.

c. Record the voltage observed in step b and rotate the adjustment R12 to each available limit, observing that the voltage on the differential voltmeter changes by at least 0.45 volts.

d. Adjust R12 for the dc voltage recorded in step c.

e. Make the equipment connections illustrated in Figure 4-8.

f. Using the Model 887A to establish the level of the ac input voltage, apply a 5 volt ac, 400 Hz, signal to the Model 853A.

g. Connect the input of a dc differential voltmeter to terminal 15 of the printed circuit board and the common lead to terminal 13. The differential voltmeter should indicate approximately 0.45455 volts dc. Record the exact voltage.

h. Rotate the adjustment R17 to each available limit, observing that the voltage on the differential voltmeter changes at least 16 millivolts.

i. Adjust R17 for the dc voltage recorded in step g.

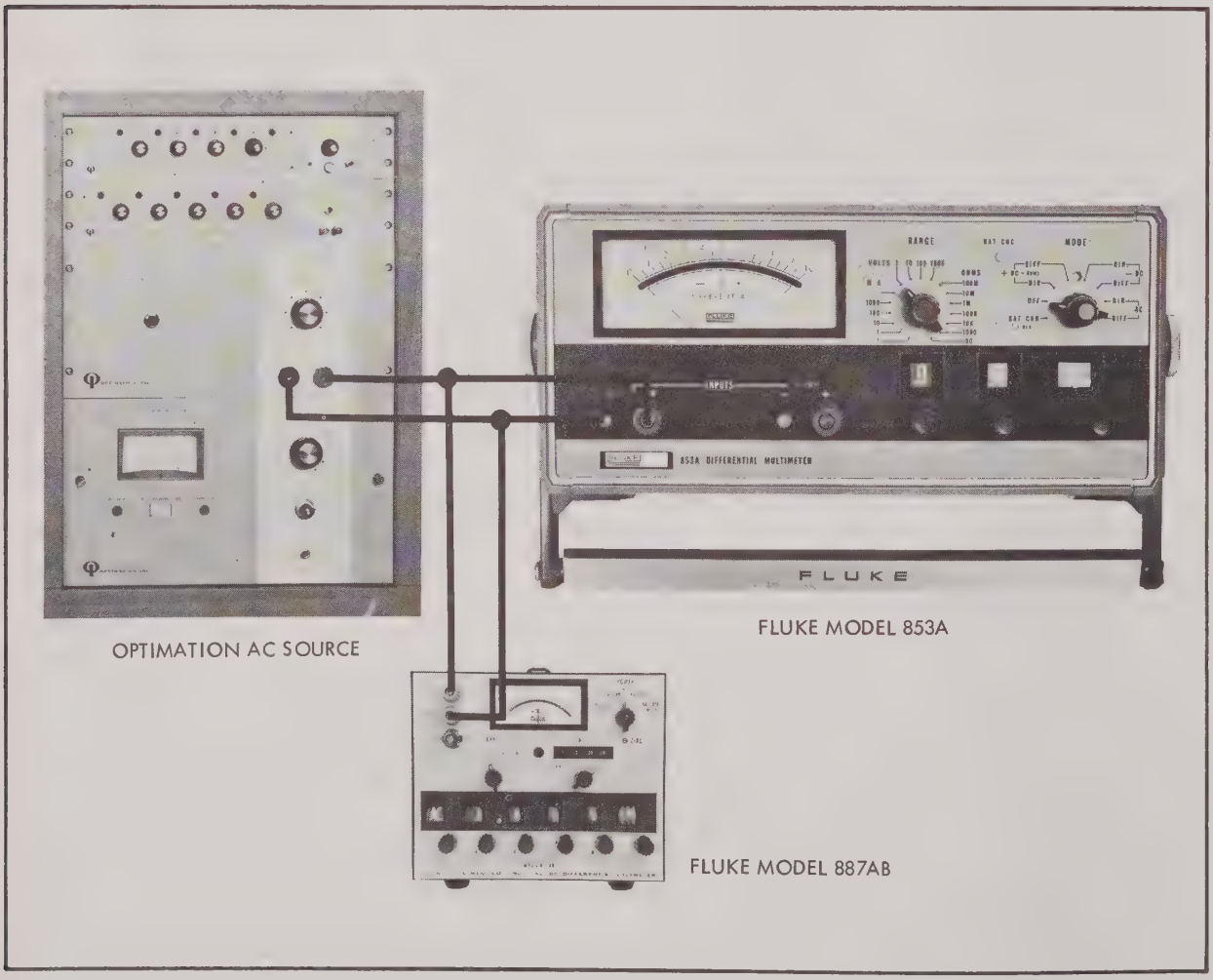


Figure 4-8. AC-DC CONVERTER CHECKS-EQUIPMENT CONNECTIONS

j. With the Model 853A RANGE switch to the position indicated in Figure 4-9, apply the 30 Hz and 30 kHz ac voltages indicated to the input of the Model 853A. The dc differential voltmeter should indicate the approximate values of Figure 4-9.

INPUT VOLTAGE (30 Hz & 30 kHz)	MODEL 853A VOLTS RANGE	APPROXIMATE DC DIFFERENTIAL VOLTMETER INDICATION
500V 100V	1000	0.45455V 20% of 500V reading
100V 10V	100	0.9091V 10% of 100V reading
10V 1V	10	0.9091V 10% of 10V reading
1V 0.1V	1	0.9091V 10% of 1V reading

Figure 4-9. AC-DC CONVERTER CHECKS

4-30. When the results of these checks agree with the information given, the AC-DC Converter is functioning properly and the test equipment can be disconnected from the Model 853A.

4-31. NULL DETECTOR AMPLIFIER CHECKS

4-32. The Null Detector Amplifier Checks require a dc voltage and current source and a dc differential voltmeter. Nominal transistor voltages and waveforms are illustrated in Figure 4-13. To perform the checks, proceed as follows:

a. Connect the input of the dc differential voltmeter to TP4 and the common input to terminal 5 of the Model 853A printed circuit board.

b. The differential voltmeter should indicate +6.8 (±0.15) volts dc.

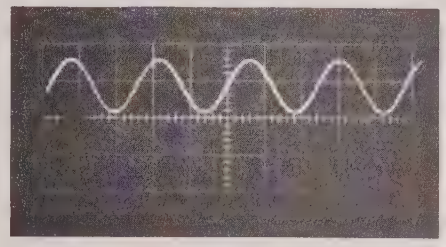
c. Connect the input of the dc differential voltmeter to TP5. The differential voltmeter should indicate -6.85 (±0.15) volts dc.

d. Connect the input of the dc differential voltmeter to terminal 9 of the printed circuit board. The differential voltmeter should indicate the voltage observed in step c.

e. Place the Model 853A MODE switch to the -DC DIFF position and record the dc differential voltmeter voltage indication.

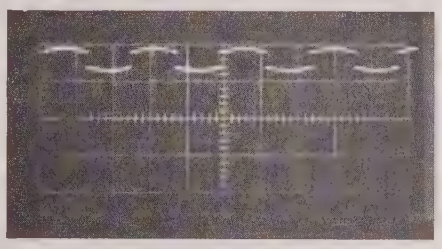
f. Rotate the adjustment R33 to each available limit, observing that the voltage on the differential voltmeter changes by at least one volt.

1 volt range 400 Hz 1 volt input



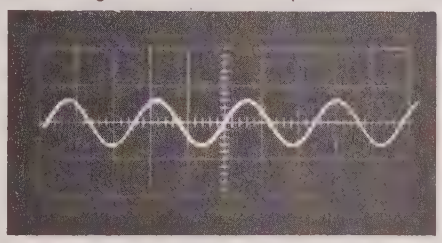
TP1 Emitter Q3 1 msec/cm

1 volt range 400 Hz 1 volt input



Emitter Q4 1 msec/cm

1 volt range 400 Hz 1 volt input



R18 Pin 12 (A1) 1 msec/cm

TRANSISTOR	EMITTER	BASE	COLLECTOR
Q1	-0.57	∅	+0.58
Q2	∅	+0.58	+1.5
Q3	+0.83	+1.5	+7
Q4	+7.75	+8.35	+10.1
Q5	-2.9	-2.35	-0.57

All waveforms taken with a dc coupled oscilloscope with an input of one volt ac, 400 Hz, applied to the Model 853A on the 1 volt range.

All transistor voltages taken under a zero input condition and are ±20% values.

Figure 4-10. AC-DC CONVERTER TRANSISTOR VOLTAGES AND WAVEFORMS

g. Adjust R33 for the voltage recorded in step e.

h. Connect the input of the dc differential voltmeter to terminal 10 of the printed circuit board. The differential voltmeter should indicate the voltage observed in step b.

i. Place the Model 853A MODE switch to the +DC DIFF position and record the dc differential voltmeter indication.

j. Rotate the adjustment R32 to each available limit, observing that the voltage on the differential voltmeter changes by at least one volt.

k. Adjust R32 for the voltage recorded in step i.

l. Place the RANGE switch to 10 VOLTS and the Readout dials to .00 00.

m. Rotate the adjustment R46 to each available limit, observing that the pointer of the Model 853A front panel meter moves to the left and right of the center-zero position. Adjust R46 for a center-zero indication, and place the MODE switch to +DC DIR.

n. Make the equipment connections illustrated in Figure 4-11, applying +10 volts dc to the input of the Model 853A.

o. Connect the input of the dc differential voltmeter to terminal 6 of the printed circuit board.

p. The differential voltmeter should indicate one volt dc (±0.005) and the Model 853A front panel meter should indicate 1.0.

q. Rotate the adjustment R34 to each available limit, observing that the pointer of the Model 853A front

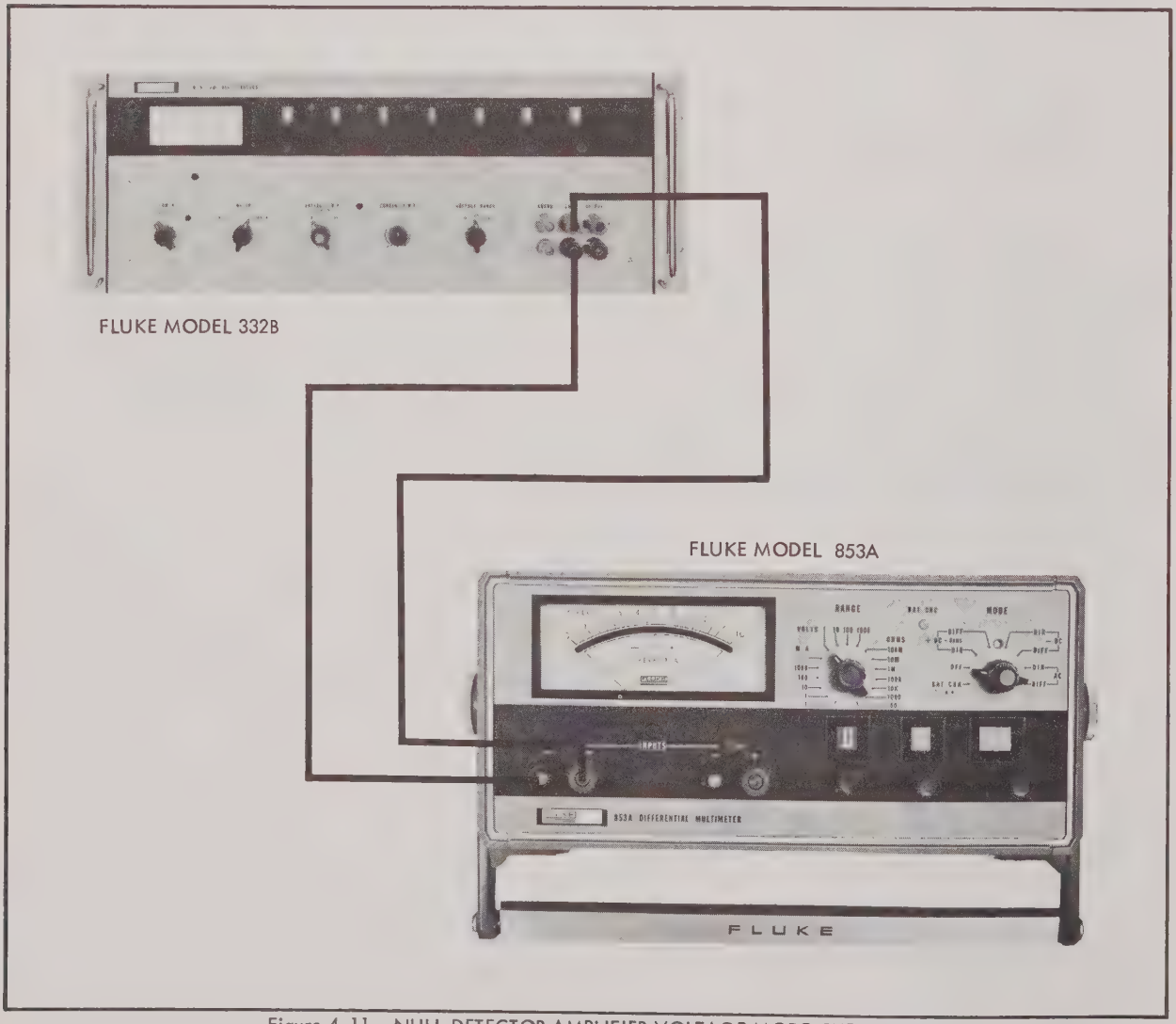


Figure 4-11. NULL DETECTOR AMPLIFIER VOLTAGE MODE CHECKS-EQUIPMENT CONNECTIONS

panel meter moves above and below (1.0) full-scale. Adjust R34 for a full-scale (1.0) meter indication upon completion of this step.

r. Reduce the input dc voltage applied to the Model 853A to one volt dc, observing that the dc differential voltmeter indicates +0.1 volts dc and the front panel meter indicates .1.

s. Place the Model 853A differential dials to .0110 and place the MODE switch to +DC DIFF. The meter pointer should be at approximately center-zero.

t. Rotate the NULL SENS control clockwise, observing that the meter pointer moves to the right of center-zero.

u. Make the equipment connections illustrated in Figure 4-12, placing the RANGE and MODE switches to 1 MA and +DC DIR positions.

v. Apply one milliampere of current to the Model 853A, observing that the dc differential voltmeter connected to terminal 6 of the printed circuit board indicates +1.0 volt dc.

w. Reduce the current applied to the input of the Model 853A to 0.1 milliampere, observing that the dc differential voltmeter connected to terminal 6 of the printed circuit board indicates +0.1 volts dc.

4-33. When the results of these checks agree with the information given, the Null Detector Amplifier is functioning properly and the test equipment can be disconnected from the Model 853A.

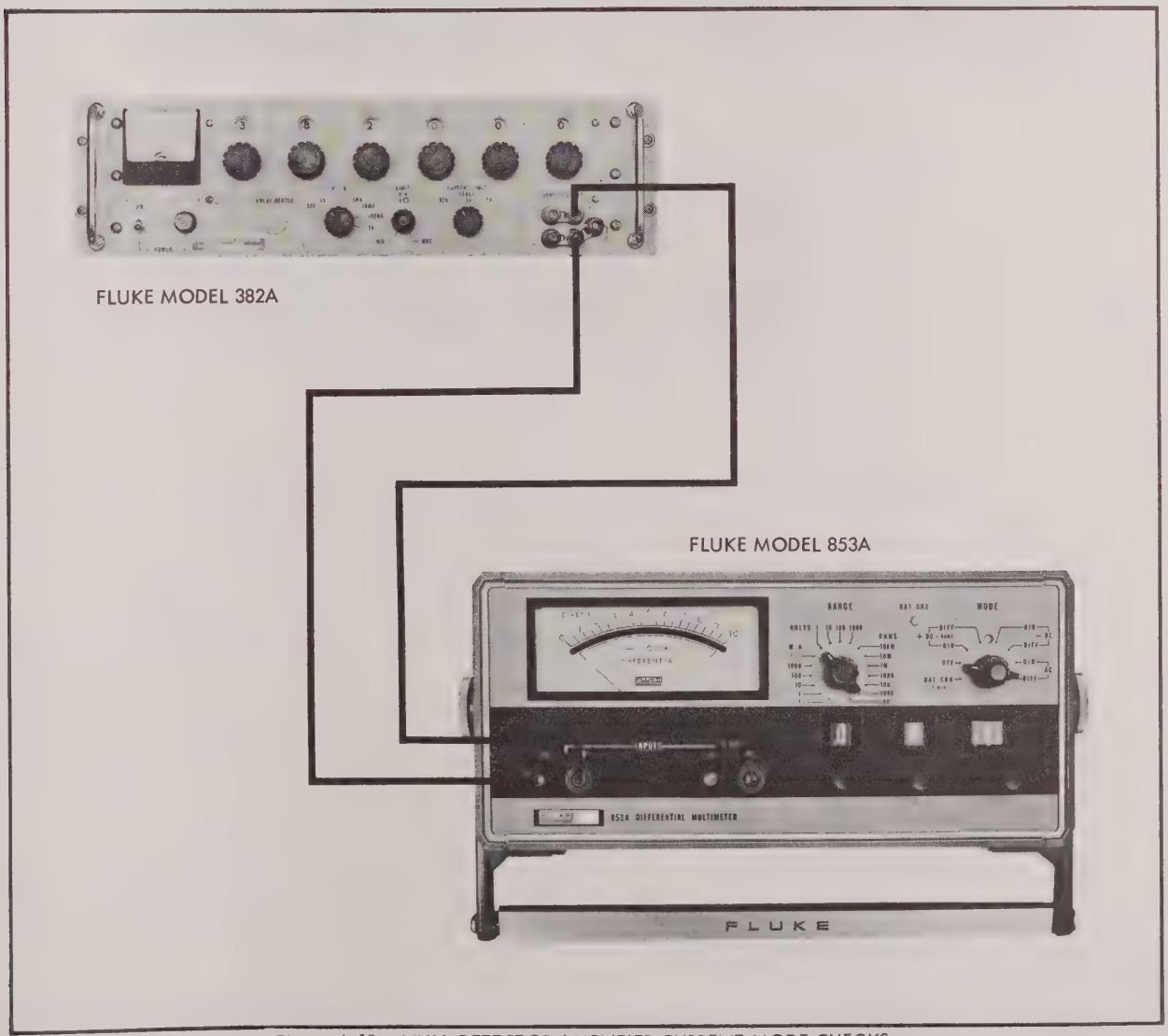
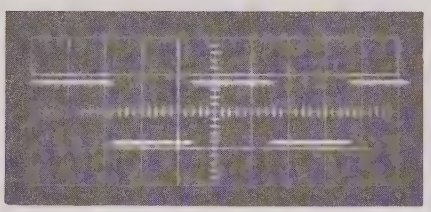
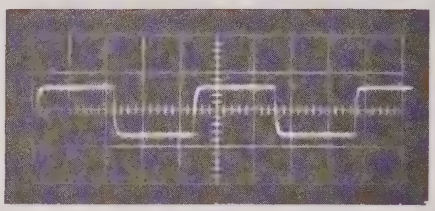


Figure 4-12. NULL DETECTOR AMPLIFIER CURRENT MODE CHECKS-EQUIPMENT CONNECTIONS

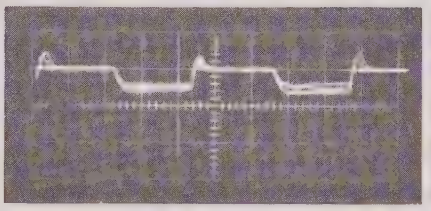


CR5/CR6 1 msec/cm



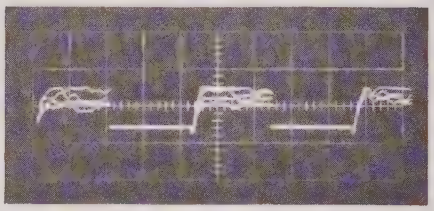
Emitter Q17 TP3 1 msec/cm

1 volt range 1 volt input



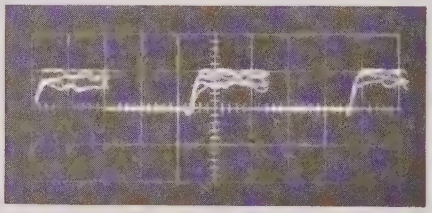
Base Q15 1 msec/cm

1 volt range 1 volt input



Collector Q15 1 msec/cm

1 volt range 1 volt input



Emitter Q16 1 msec/cm

TRANSISTOR	EMITTER	BASE	COLLECTOR
Q11	SOURCE	GATE	DRAIN
	DO NOT MEASURE		
Q12	Ø	(observe across C19) +0.43	+0.5
Q13	Ø	+0.5	+0.585
Q14	Ø	+0.585	+3.2
Q15	+3.85	+3.2	-0.4
Q16	Ø (No Signal)	+3.6	Ø
Q17	See TP3	-2.8	+3.8

All waveforms are taken with an ac coupled oscilloscope with an input of one volt dc applied to the Model 853A on the 1 VOLT range.

All transistor voltages taken under a zero input condition and are ±20% values.

Figure 4-13. NULL DETECTOR AMPLIFIER TRANSISTOR VOLTAGES AND WAVEFORMS

4-34. CALIBRATION PROCEDURES

4-35. INTRODUCTION

4-36. The Model 853A should be checked for calibration annually. Before attempting to calibrate your instrument, it is recommended that the major portions of the instrument circuitry be checked using the methods described in paragraphs 4-18 through 4-33.

4-37. It will be necessary to apply various dc voltages and currents, ac voltages and currents, and known resistance values to the inputs of the instrument during calibration. Recommended methods of obtaining these desired sources are given at the beginning of each procedure.

4-38. Calibration of the instrument should be performed on line power with the top dust cover removed and in a draft free area at an ambient temperature of 72° F. Adjustments and test point locations are illustrated in Figure 4-4.

4-39. METER MECHANICAL ZERO ADJUST

4-40. With the power removed from the Model 853A, proceed as follows:

a. Position the instrument horizontally (normal position) on the bench.

b. Adjust the meter mechanical zero screw, accessible from the front panel, until the meter pointer is to the left-zero position. Back off the screw adjustment just enough to disengage the cam once the left-zero indication is obtained.

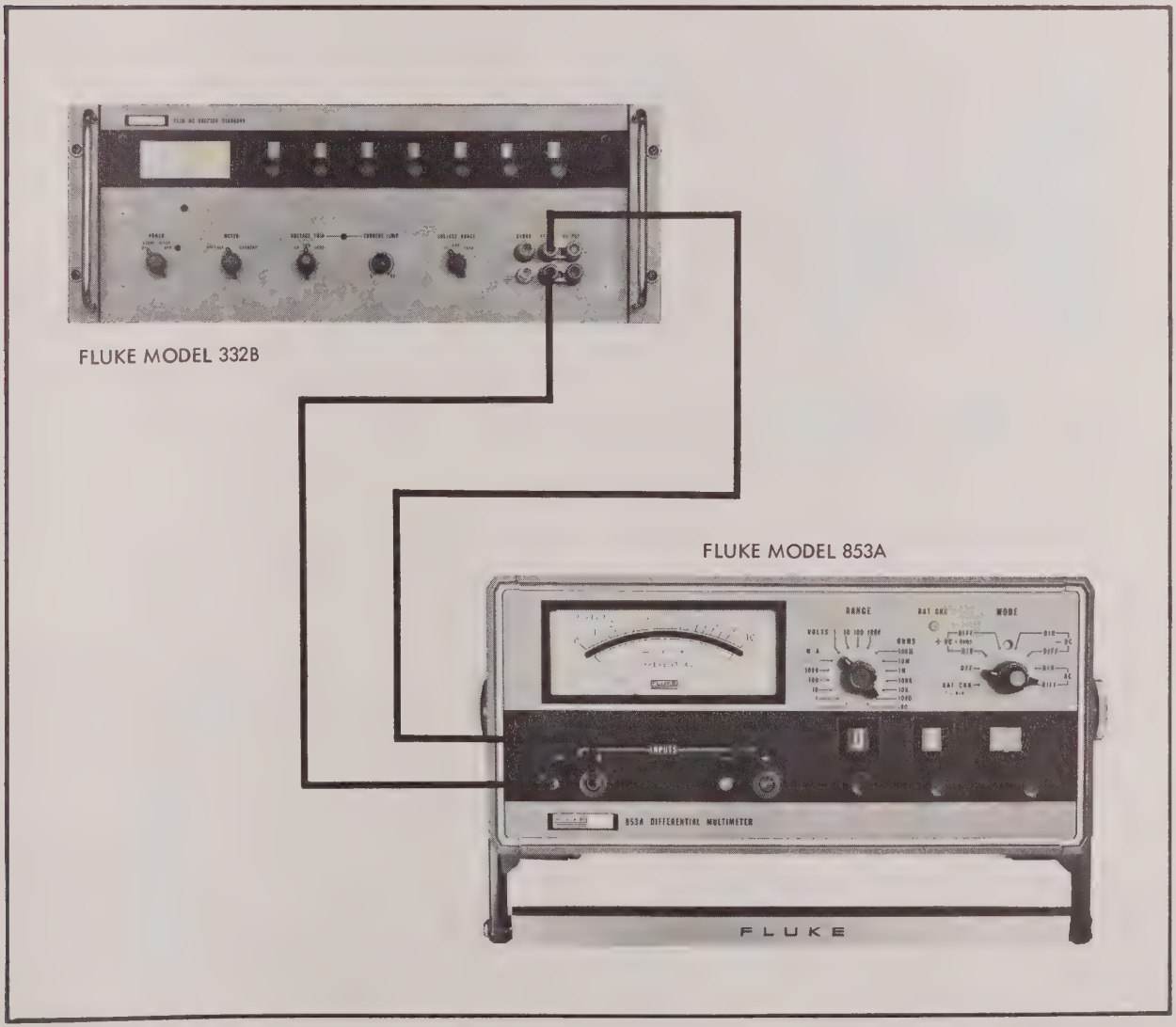


Figure 4-14. DC VOLTMETER- CALIBRATION EQUIPMENT CONNECTIONS

4-41. DC VOLTMETER MODE CALIBRATION

4-42. Calibration of the Model 853A dc voltmeter requires a dc voltage of one volt which has an accuracy of ±0.02%. A voltage calibrator such as the Fluke Model 332B can be used to obtained the necessary accurate dc voltage. To calibrate the Model 853A dc voltmeter modes, apply ac line power to the instrument and proceed as follows:

a. Place the Model 853A controls as follows:

MODE	+DC DIR
RANGE	1 VOLT
NULL SENS	Maximum Counter-Clockwise
Readout dials	000

b. Make the equipment connections illustrated in Figure 4-14, applying +1.0 volt dc ±0.02% to the Model 853A.

c. Adjust R34 for a full-scale meter indication of 1.0.

d. Disconnect the dc input voltage applied to the Model 853A and place the MODE switch to -DC DIR.

e. Apply -1.0 volt dc ±0.02% to the Model 853A input terminals, observing that a full-scale meter deflection of 1.0 (±1/4 small division) is obtained.

f. Disconnect the dc input voltage applied to the Model 853A and place the MODE and RANGE switches to their respective +DC DIFF and 10A positions.

g. Adjust R32 for an exact center-zero meter indication.

h. Place the MODE switch to -DC DIFF and adjust R33 for an exact center-zero meter indication.

i. Place the MODE switch to +DC DIFF and rotate the NULL SENS control fully clockwise.

j. Adjust R46 for an exact center-zero meter indication.

k. Place the MODE switch to -DC DIFF, observing that the center-zero meter indication is within ±1/2 of a small division.

l. Place the MODE and RANGE switches to their respective +DC DIFF and 1 VOLT positions, verifying that the NULL SENS is still fully clockwise.

m. Adjust the Readout dials for a left-zero meter deflection. The Readout dials should indicate .0015 to .0020.

n. Place the Readout dials to 1.000 and apply +1.0 volt dc ±0.02% to the Model 853A input terminals.

o. Adjust R78 for an exact center-zero meter indication.

p. Disconnect the dc input voltage applied to the Model 853A and place the MODE switch to -DC DIFF.

q. Apply -1.0 volt dc ±0.02% to the Model 853A input terminals, observing that the meter indicates center-zero (±2 major divisions). Disconnect the dc input voltage upon completion of this step.

r. Place the MODE switch to +DC DIFF and set the Readout dials to 1.000.

s. With the RANGE switch to the VOLTS position indicated in Figure 4-15, apply the corresponding dc input voltage to the Model 853A. The meter should indicate center-zero (±8 major divisions) on each range.

RANGE	INPUT VOLTAGE ±0.02%
1	1
10	10
100	100
1000	1000

Figure 4-15. DC VOLTAGE RANGE CHECKS

4-43. DECADE POTENTIOMETER CALIBRATION

4-44. Calibration of the Decade Potentiometer requires a dc voltage from 0.008 to 0.8 volts which has an accuracy of ±0.02%. A voltage calibrator such as the Fluke Model 332B can be used to obtain the necessary accurate voltages. To calibrate the Decade Potentiometer, apply ac line power to the instrument and proceed as follows:

a. Place the Model 853A controls as follows:

MODE	+DC DIFF
RANGE	1 VOLT
NULL SENS	Maximum Clockwise
Readout dials	.800

b. Make the equipment connections illustrated in Figure 4-16.

c. With the Readout dials to the position indicated in Figure 4-17, apply the corresponding input voltage to the Model 853A. The meter should indicate center-zero ± the deviation noted in Figure 4-17 for each input voltage.

d. Apply 0.008 volts dc to the Model 853A and place the Readout dials to .0080, observing that the meter indicates center-zero (± one major division).

e. If the results of step d are not obtained, adjust the extreme right-hand Readout dial for center-zero on the meter and remove the bottom dust cover from the instrument.

f. Loosen the coupler on the right-hand Readout dial indicator shaft and position the dial indicator for

FLUKE MODEL 332B

FLUKE MODEL 853A

Figure 4-16. DECADE POTENTIOMETER - CALIBRATION EQUIPMENT CONNECTIONS

READOUT DIALS	INPUT VOLTAGE (±0.02%)	DEVIATION FROM CENTER-ZERO (MAJOR DIVISIONS)
.800	0.8	8
.600	0.6	7
.400	0.4	6
.200	0.2	5
.100	0.1	4
.0X0	0.1	4
.080	0.08	3
.060	0.06	2
.040	0.04	2
.020	0.02	2
.010	0.01	2

Figure 4-17. DECADE POTENTIOMETER CHECKS

an indication of 80. Refer to Figure 4-18 for location of this coupler. Securely tighten the coupler upon completion of this step.

g. Remove the input dc voltage applied to the Model 853A and rotate the extreme right-hand Readout dial to each available limit, observing that the end stops occur at "O" and "X".

h. Place the Readout dials to .000, observing that the meter indicates center-zero (± one small division).

4-45. DC AMMETER CALIBRATION

4-46. Calibration of the Model 853A dc ammeter modes requires a dc current source from 0.1 milliampere to 2 amperes which has an accuracy of ±0.02%. A voltage/current calibrator such as the Fluke Model 382A can be used to obtain the necessary accurate dc currents. To calibrate the Model 853A dc ammeter modes, apply ac power to the instrument and proceed as follows:

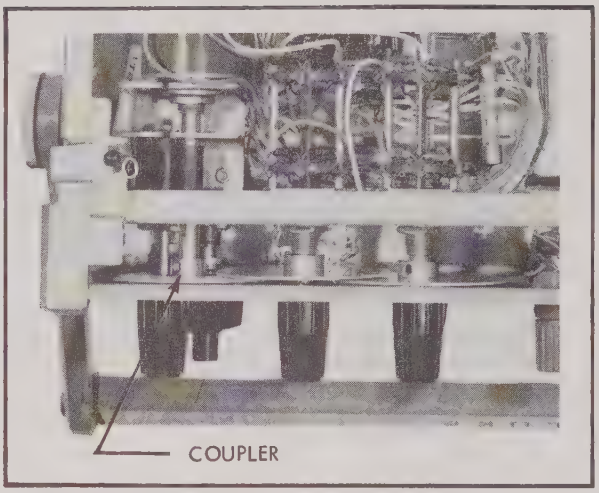


Figure 4-18. LOCATION OF VERNIER READOUT DIAL COUPLER

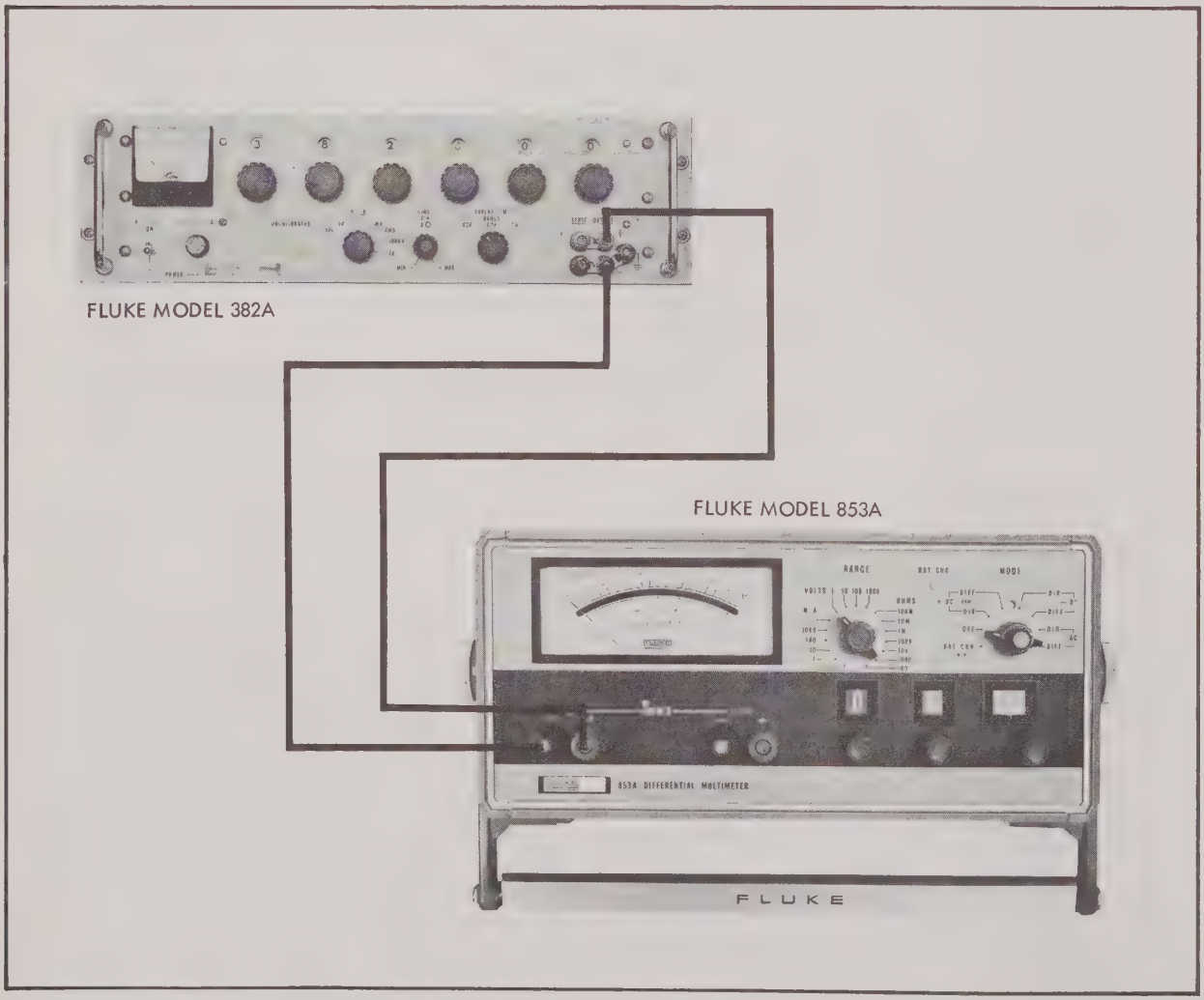


Figure 4-19. DC AMMETER .1 MA TO 1000 MA- CALIBRATION EQUIPMENT CONNECTIONS

a. Place the Model 853A controls as follows:

MODE	+DC DIFF
RANGE	.1 MA
NULL SENS	Maximum Clockwise
Readout dials	1.000

b. Make the equipment connections illustrated in Figure 4-19.

c. Apply the dc currents indicated in Figure 4-20 on the corresponding MA ranges, observing that the meter indicates center-zero (±2.6 major divisions).

d. With 1000 ma applied to the input of the Model 853A, place the MODE switch to +DC DIR and observe that the meter indicates 1.0 (± 1/4 small division).

e. When the Model 853A controls are placed to the following positions, observe that the meter indicates center-zero (± 1/2 small division).

MODE	+DC DIFF
RANGE	10A
NULL SENS	Maximum Clockwise
Readout dials	.000

f. Make the equipment connections illustrated in Figure 4-21.

g. Place the Readout dials to .200 and apply 2 amperes to the input of the Model 853A.

RANGE	INPUT CURRENT ±0.02%
.1	100 ua
1	1 ma
10	10 ma
100	100 ma
1000	1000 ma

Figure 4-20. DC AMMETER RANGE CHECKS

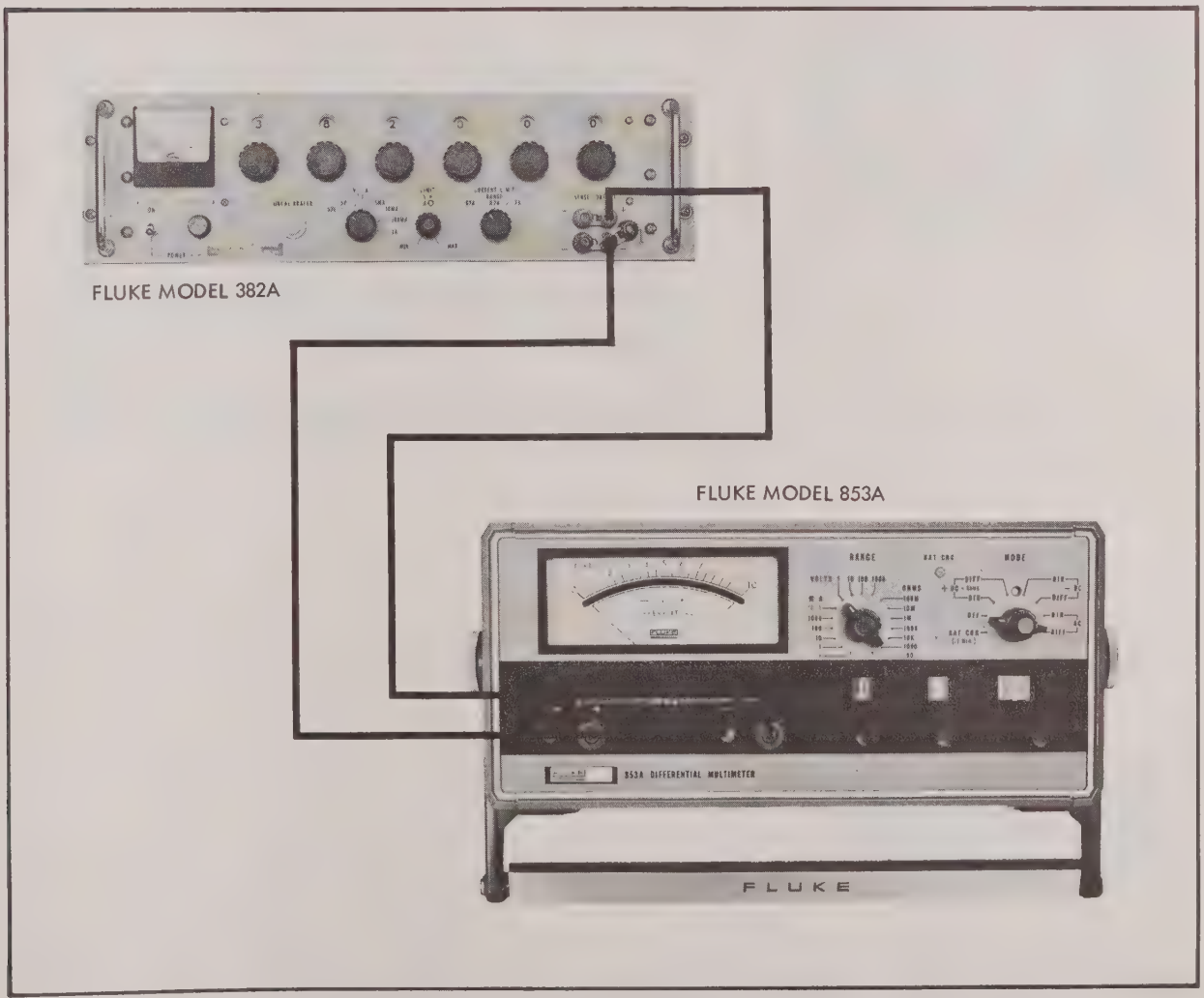


Figure 4-21. DC AMMETER 10 AMP RANGE- CALIBRATION EQUIPMENT CONNECTIONS

h. Adjust R60 for an exact center-zero meter indication.

i. Place the MODE switch to the +DC DIR position, observing that the meter indicates . 2 (± 1/4 small division).

4-47. AC VOLTMETER CALIBRATION

4-48. Calibration of the ac voltmeter modes requires an ac voltage of 1 to 500 volts ±0. 1% over a frequency range of 20 Hz to 30 kHz. An ac power source such as the Optimation Model AC101A, when used in conjunction

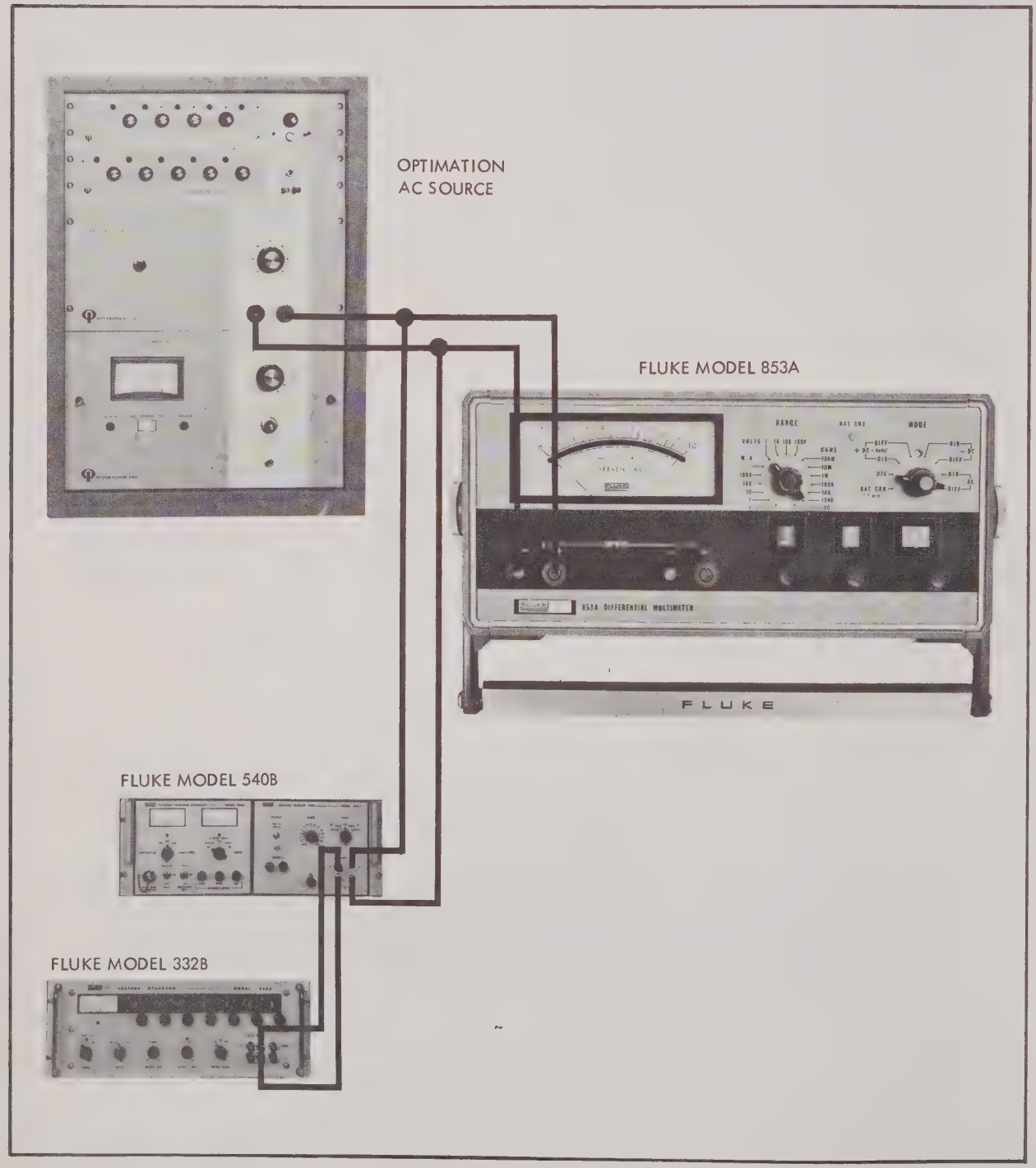


Figure 4-22. AC VOLTMETER- CALIBRATION EQUIPMENT CONNECTIONS

with the Fluke Model 540B Transfer Standard and the Fluke Model 332B Voltage Calibrator, can be used to obtain the necessary accurate ac voltages. To calibrate the Model 853A ac voltage mode, apply ac line power to the instrument and proceed as follows:

a. Place the Model 853A controls as follows:

MODE	AC DIFF
RANGE	1000 VOLTS
NULL SENS	Maximum Counter-Clockwise
Readout dials	.0050

b. Connect the input of a dc differential voltmeter to TP1 and the common lead to terminal 13 of the printed circuit board.

c. Adjust R12 for an indication of 0.85 (±0.05) volts dc. Disconnect the voltmeter upon completion of this step.

d. Rotate the NULL SENS control clockwise until the meter indicates left-zero. The NULL SENS control must remain in this position for the duration of the following ac voltmeter adjustments.

e. Set the Readout dials to 1.000 and place the RANGE switch to the 1 VOLTS position.

f. Make the equipment connections illustrated in Figure 4-22 and apply 1 volt ac ±0.1% at 400 Hz to the Model 853A input terminals.

g. Adjust R17 for an exact center-zero meter indication.

h. Apply 1 volt ac ±0.1% at 30 kHz to the Model 853A input terminals and adjust A2C5 for an exact center-zero meter indication.

i. Apply the ac input voltages on the ranges indicated in Figure 4-23 through 4-25, observing that the meter center-zero indication is within the prescribed limits.

j. Remove the ac input voltage applied to the Model 853A input terminals and place the RANGE switch to the 1000 VOLTS position.

k. Place the Readout dials to .500 and apply a 500 volt ac ±0.1%, 400 Hz, signal to the Model 853A input terminals, observing that the meter center-zero indication is within ±5 major divisions.

l. Apply a 15 kHz 500 volt ac input signal, observing that the meter indicates center-zero (±8 major divisions).

	1 VAC INPUT (±0.1%)	MAXIMUM METER CENTER-ZERO DEVIATION (Major Divisions)
1 VOLT RANGE	20 kHz	±2
	20 Hz	±2

Figure 4-23. 1 VOLT AC RANGE CHECKS

	10 VAC INPUT (±0.1%)	MAXIMUM METER CENTER-ZERO DEVIATION (Major Divisions)
10 VOLT RANGE	20 Hz	±8
	30 Hz	±6
	400 Hz	±5
	20 kHz	±8
	30 kHz	±10

Figure 4-24. 10 VOLT AC RANGE CHECKS

	100 VAC INPUT (±0.1%)	MAXIMUM METER CENTER-ZERO DEVIATION (Major Divisions)
100 VOLT RANGE	30 kHz	±10
	20 kHz	±8
	400 Hz	±5
	30 Hz	±6
	20 Hz	±8

Figure 4-25. 100 VOLT AC RANGE CHECKS

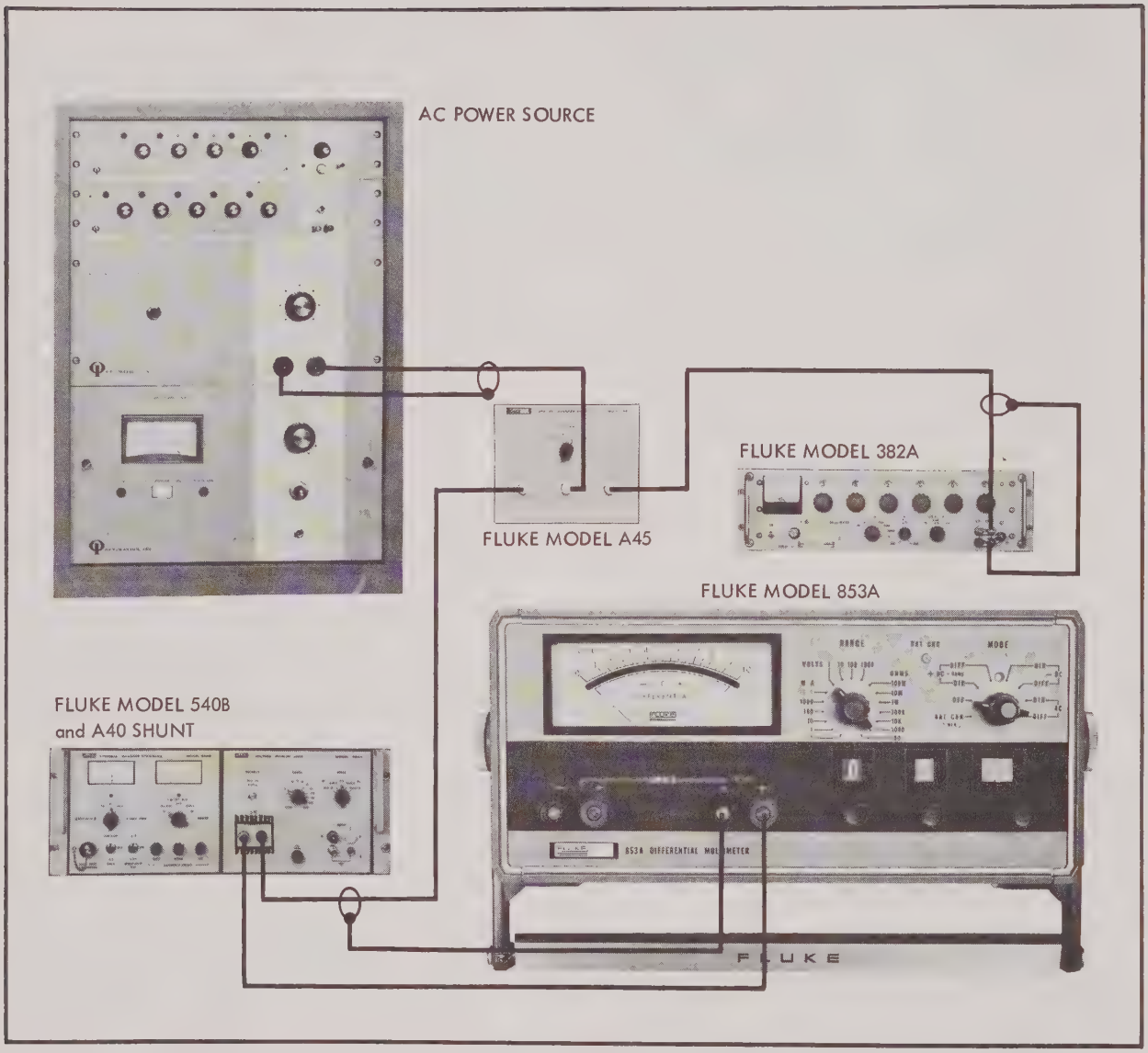


Figure 4-30. AC AMMETER 10 AMP RANGE- CALIBRATION EQUIPMENT CONNECTIONS

RANGE (OHMS)	INPUT RESISTANCE (±0.3%)	METER INDICATION (± small divisions)
100	100	1.0 ± 1
1000	1K	1.0 ± 1
10K	10K	1.0 ± 1-1/2
100K	100K	1.0 ± 1-1/2
1M	1M	1.0 ± 1-1/2
10M	5M	.5 ± 1
10M	10M	1.0 ± 1-1/2
100M	50M	.5 ± 1-1/2
100M	100M	1.0 ± 2

Figure 4-31. DIRECT OHMMETER CHECKS

RANGE (OHMS)	INPUT RESISTANCE (±0.05%)	READOUT DIAL DEVIATION ABOVE OR BELOW 1.000
100M	100M	.997 - 1.003
10M	10M	.999 - 1.001
1M	1M	.999 - 1.001
100K	100K	.999 - 1.001
10K	10K	.999 - 1.001
1000	1000	.999 - 1.001
100	100	.999 - 1.001

Figure 4-32. DIFFERENTIAL OHMMETER CHECKS

SECTION V

LIST OF REPLACEABLE PARTS

5-1. INTRODUCTION

5-2. This section contains complete descriptions of those parts one might normally expect to replace during the life of the instrument. The first listing is a breakdown of all of the major assemblies in the instrument. Subsequent listings itemize the components in each assembly. Every listing is accompanied by an illustration identifying each component in the listing. Assemblies and subassemblies are identified by a reference designation beginning with the letter A, (e.g., A1, etc.). Components are identified by the schematic diagram reference designation (e.g. R1, C107, DS1). Parts not appearing on the schematic diagram are identified by only a location index number. Flagnotes are used throughout the parts list and refer to ordering explanations. Explanations for these flagnotes appear at the end of each assembly parts list.

5-3. COLUMNAR INFORMATION

a. The REF DESIG column indexes the item description to the associated illustration. In general the reference designations are listed under each assembly in alpha-numeric order. Subassemblies of minor proportions are sometimes listed with the assembly of which they are a part. In this case, the reference designations for the components of the subassembly may appear out of order.

b. The INDEX NO. column lists coordinates which locate the designated part on the associated illustration.

c. The DESCRIPTION column describes the salient characteristics of the component. Indention of the description indicates the relationship to other assemblies, components, etc. In many cases it is necessary to abbreviate in this column. For abbreviations and symbols used, see the following page.

d. The ten-digit part number by which the item is identified at the John Fluke Mfg. Co. is listed in the STOCK NO. column. Use this number when ordering parts from the factory or authorized representatives.

e. The Federal Supply Code for the item manufacturer is listed in the MFR column. An abbreviated list of Federal Supply Codes is included in the Appendix.

f. The part number which uniquely identifies the item to the original manufacturer is listed in the MFR PART NO column. If a component must be ordered by description, the type number is listed.

g. The TOT QTY column lists the total quantity of the item used in the instrument. Second and subsequent listing of the same item are referenced to the first listing with the abbreviation REF. In the case of optional subassemblies, plug ins, etc. that are not always part of the instrument, the TOT QTY column lists the total quantity of the item in that particular assembly.

h. Entries in the REC QTY column indicate the recommended number of spare parts necessary to support one to five instruments for a period of two years. This list presumes an availability of common electronic parts at the maintenance site. For maintenance for one year or more at an isolated site, it is recommended that at least one of every part in the instrument be stocked.

i. The USE CODE column identifies certain parts which have been added, deleted or modified during the production of the instrument. Each part for which a Use Code has been assigned may be identified with a particular instrument serial number by consulting the Serial Number Effectivity List at the end of the parts list. As Use Codes are added to the list, the TOT QTY column listings are changed to reflect the most current information. Sometimes when a part is changed, the new part can and should be used as a replacement for the original part. In this event a parenthetical note is added in the DESCRIPTION column.

5-4. HOW TO OBTAIN PARTS

5-5. Standard components have been used wherever possible. Standard components may be ordered directly from the manufacturer by using the manufacturer's part number, or parts may be ordered from the John Fluke Mfg. Co. factory or authorized representative by using the Fluke part number. In the event the part you order has been replaced by a new or improved part, the replacement will be accompanied by an explanatory note and installation instructions, if necessary.

5-6. You can insure prompt and efficient handling of your order to the John Fluke Mfg. Co. if you include the following information:

a. Quantity.

b. FLUKE Stock Number.

c. Description.

d. Reference Designation.

e. Instrument model and serial number.

Example: 2 each, 4805-177105, Transistors, 2N3565, Q107-108 for 845AR, s/n 168.

If you must order structural parts not listed in the parts list, describe the part as completely as possible. A sketch of the part showing its location to other parts of the instrument is usually most helpful.

5-7. LIST OF ABBREVIATIONS

ac	alternating current	mw	milliwatt
Al	Aluminum	na	nanoampere
amp	ampere	nsec	nanosecond
assy	assembly	nv	nanovolt
cap	capacitor	Ω	ohm
car flm	carbon film	ppm	parts per million
C	centrigrade	piv	peak inverse voltage
cer	ceramic	p-p	peak to peak
comp	composition	pf	picofarad
conn	connector	plstc	plastic
db	decibel	p	pole
dc	direct current	pos	position
dpdt	double-pole, double-throw	P/C	printed circuit
dpst	double-pole, single-throw	rf	radio frequency
elect	electrolytic	rfi	radio frequency interference
F	fahrenheit	res	resistor
Ge	germanium	rms	root mean square
gmv	guaranteed minimum value	rtry	rotary
h	henry	sec	second
Hz	hertz	sect	section
hf	high frequency	S/N	serial number
IC	integrated circuit	Si	silicon
if	intermediate frequency	scr	silicon controlled rectifier
k	kilohm	spdt	single-pole, double-throw
kHz	kilohertz	spst	single-pole, single-throw
kv	kilovolt	sw	switch
lf	low frequency	Ta	tantalum
MHz	megahertz	tstr	transistor
M	megohm	tvm	transistor voltmeter
met flm	metal film	uhf	ultrahigh frequency
ua	microampere	vtvm	vacuum tube voltmeter
uf	microfarad	var	variable
uh	microhenry	vhf	very high frequency
usec	microsecond	vlf	very low frequency
uv	microvolt	v	volt
ma	milliampere	va	voltampere
mh	millihenry	vac	volts, alternating current
m	milliohms	vdc	volts, direct current
msec	millisecond	w	watt
mv	millivolt	ww	wire wound

REF DESIG	INDEX NO	DESCRIPTION	STOCK NO	MFR	MFR PART NO	TOT QTY	REC QTY	USE CODE
		DIFFERENTIAL MULTIMETER Figure 5-1						
		Replaceable Battery Unit Rechargeable Battery Unit	853A 853A-01					
A1	D2-L3	Printed Circuit Board Assembly (See Figure 5-2)	1702-228536 (853A-4001)	89536	1702-228536	1		
A2	D4-J5	Range Switch Assembly (See Figure 5-3)	5110-228668 (853A-4628)	89536	5110-228668	1		
A3	D5-I5	Mode Switch Assembly (See Figure 5-4)	5110-228676 (853A-4629)	89536	5110-228676	1		
A4	E5-K3	Final Assembly (See Figure 5-5)						
A5	C5-J5	Decade Potentiometer, Deck "A" Assembly (See Figure 5-6)	5110-228643 (853A-4612)	89536	5110-228643	1		
A6	C5-J2	Decade Potentiometer, Deck "B" Assembly (See Figure 5-6)	5110-228650 (853A-4613)	89536	5110-228650	1		
A7	B3-K1	Front Panel Assembly (See Figure 5-7)						

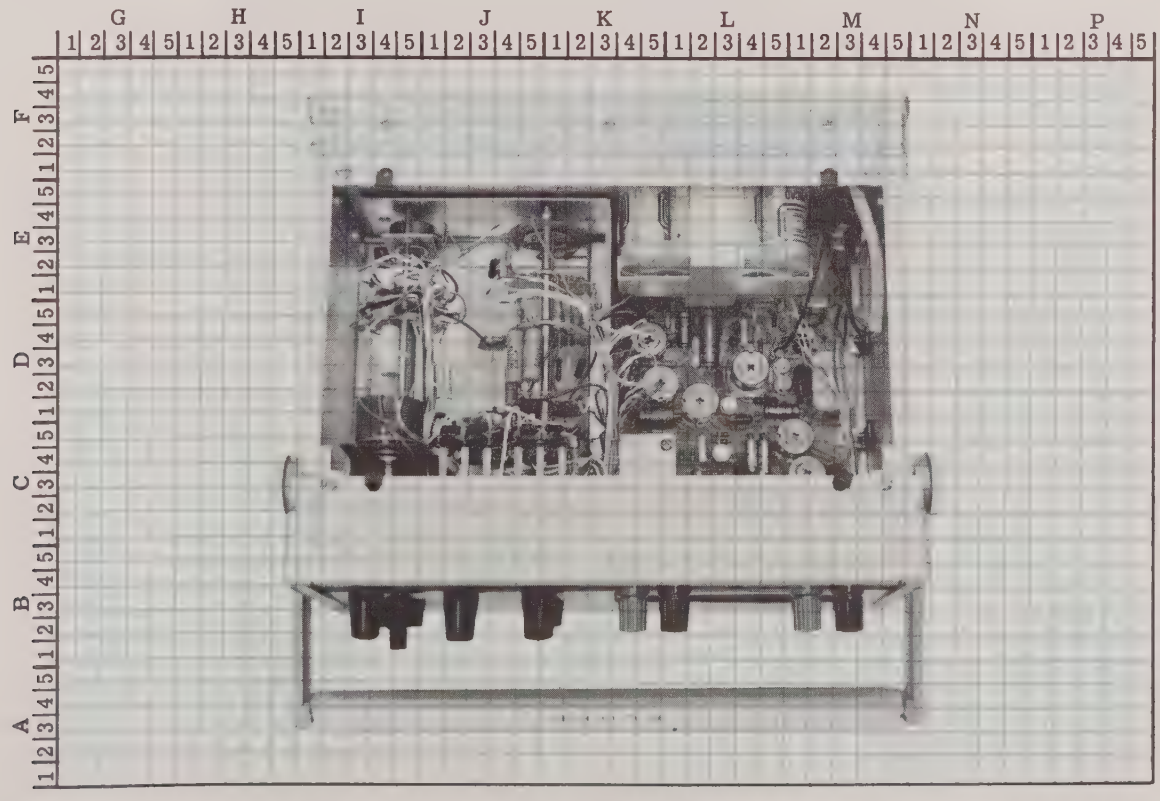


Figure 5-1. MODEL 853A DIFFERENTIAL MULTIMETER

REF DESIG	INDEX NO	DESCRIPTION	STOCK NO	MFR	MFR PART NO	TOT QTY	REC QTY	USE CODE
A1		**PRINTED CIRCUIT BOARD ASSEMBLY Figure 5-2**	1702-228536 (853A-4001)	89536	1702-228536	REF		
C1		Not used						
C2	J4-P4	Cap, Ta, 33 uf ±10%, 10v	1508-182832	05397	K33C10K	1	1	
C3	K4-P5	Cap, mica, 470 pf ±5%, 500v	1504-148429	88419	CD19F471J	1		
C4	J4-Q3	Cap, Ta, 6.8 uf ±10%, 35v	1508-182782	05397	K6R8C35K	1	1	
C5	J4-Q5	Cap, Ta, 150 uf +20/-15%, 15v	1508-160945	56289	109D157C-2015TO	1	1	
C6	H5-Q3	Cap, elect, 50 uf +50/-10%, 25v	1502-168823	73445	C426ARF50	2	2	
C7	K3-P2	Cap, mica, 47 pf ±5%, 500v	1504-148536	88419	CD15E470J	1		
C8	H4-R1	Cap, elect, 250 uf +50/-10%, 16v	1502-187765	73445	C437ARE250	1	1	
C9		Not used						
C10	E1-P3	Cap, plstc, 0.022 uf ±20%, 100v	1507-106039	72928	355B223M	1		
C11	D1-P3	Cap, plstc, 0.01 uf ±20%, 100v	1507-235390	84411	Type 663UW	1		
C12	D1-N5	Cap, plstc, 0.0022 uf ±10%, 200v	1507-236794	56289	192P22292	2		
C13	C5-Q2	Cap, plstc, 0.047 uf ±20%, 250v	1507-162008	73445	C280AE/P47K	1		
C14	C2-P3	Cap, cer, 15 pf ±10%, 500v	1501-159947	00656	Type C1-1	1		
C15	E3-Q5	Cap, plstc, 0.0022 uf ±10%, 200v	1507-236794	56289	192P22292	REF		
C16	E1-S4	Cap, elect, 10 uf +50/-10%, 25v	1502-170266	73445	C426ARF10	2	2	
C17	E1-S2	Cap, elect, 10 uf +50/-10%, 25v	1502-170266	73445	C426ARF10	REF		
C18	F3-P3	Cap, elect, 125 uf +50/-10%, 16v	1502-186296	73445	C426ARE125	1	1	
C19	C4-Q4	Cap, elect, 5 uf +50/-10%, 64v	1502-218966	73445	C426ARH5	1	1	
C20	C2-U3	Cap, elect, 200 uf +50/-10%, 10v	1502-236935	73445	C426ARD200	2	2	
C21	C5-U3	Cap, elect, 200 uf +50/-10%, 10v	1502-236935	73445	C426ARD200	REF		
C22	G2-T4	Cap, plstc, 0.1 uf ±10%, 100v	1507-248336	88419	DMF1P1	1		
C23		Not used						
C24	C2-S1	Cap, plstc, 0.0047 uf ±20%, 200v	1507-106054	56289	192P47202	1		
C25	F3-T1	Cap, elect, 50 uf +50/-10%, 25v	1502-168823	73445	C426ARF50	REF		
C26 thru C29		Not used						
C30	J5-R5	Cap, elect, 250 uf +50/-10%, 40v	1502-178616	73445	C437ARG250	1	1	
CR1	I2-Q4	Diode, silicon, 75 ma, 25 piv	4802-241422	03508	IN4009	2	1	
CR2	I5-Q2	Diode, silicon, 75 ma, 25 piv	4802-241422	03508	IN4009	REF		
CR3, CR4		Not used						
CR5	D3-U4	Diode, silicon, 1 amp, 100 piv	4802-116111	05277	IN4817	8	2	
CR6	D4-U3	Diode, silicon, 1 amp, 100 piv	4802-116111	05277	IN4817	REF		
CR7	F2-S1	Diode, silicon, 1 amp, 100 piv	4802-116111	05277	IN4817	REF		
CR8, CR9		Not used						
CR10	H4-T4	Diode, silicon, 1 amp, 100 piv	4802-116111	05277	IN4817	REF		
CR11	H3-T4	Diode, silicon, 1 amp, 100 piv	4802-116111	05277	IN4817	REF		
CR12	J3-S3	Diode, silicon, 1 amp, 100 piv	4802-116111	05277	IN4817	REF		
CR13	I4-S3	Diode, germanium, 80 ma, 100 piv	4802-149187	07933	IN270	1	1	
Q1	K3-N4	Tstr, silicon, NPN	4805-168716	07263	S19254	3	1	
Q2	K2-P3	Tstr, silicon, NPN	4805-177105	07263	2N3565	7	2	

REF DESIG	INDEX NO	DESCRIPTION	STOCK NO	MFR	MFR PART NO	TOT QTY	REC QTY	USE CODE
Q3	K1-Q1	Tstr, silicon, NPN	4805-218081	04713	MPS6520	1	1	
Q4	J2-P5	Tstr, silicon, NPN	4805-177105	07263	2N3565	REF		
Q5	J5-N4	Tstr, silicon, NPN	4805-177105	07263	2N3565	REF		
Q6 thru Q9		Not used						
Q10	E3-P1	Tstr, silicon, PNP	4805-203364	07263	2N3638	2	1	
Q11	C4-P1	Tstr, MOS FET	4805-226043	04713	2N4352	1	1	
Q12	D3-P1	Tstr, silicon, NPN	4805-168716	07263	S19254	REF		
Q13	D3-P4	Tstr, silicon, NPN	4805-168716	07263	S19254	REF		
Q14	D3-Q3	Tstr, silicon, NPN	4805-177105	07263	2N3565	REF		
Q15	D4-R5	Tstr, silicon, PNP	4805-225599	07263	S22650	1	1	
Q16	E2-R3	Tstr, germanium, PNP	4805-182709	01295	GA2877	1	1	
Q17	C3-R1	Tstr, silicon, NPN	4805-177105	07263	2N3565	REF		
Q18, Q19		Not used						
Q20	G2-T2	Tstr, germanium, PNP	4805-148619	01295	2N1303	2	1	
Q21	G5-T2	Tstr, germanium, PNP	4805-148619	01295	2N1303	REF		
Q22	I3-R4	Tstr, silicon, PNP	4805-203364	07263	2N3638	REF		
Q23	H5-R5	Tstr, silicon, NPN	4805-177105	07263	2N3565	REF		
Q24	H3-R4	Tstr, silicon, NPN	4805-177105	07263	2N3565	REF		
Q25	F4-R4	Tstr, selected and matched	1					
R1	J3-P1	Res, comp, 120k ±5%, 1/4w	4704-193458	01121	CB1245	2		H
R1	J3-P1	Res, met flm, 121k ±1%, 1/8w	4705-229369	91637	Type MFF-1/8	1		I
R2	K2-P1	Res, comp, 180k ±5%, 1/4w	4704-193441	01121	CB1845	1		
R3	J5-P3	Res, comp, 68k ±6%, 1/4w	4704-148171	01121	CB6835	3		H
R3	J5-P3	Res, met flm, 68.1k ±1%, 1/8w	4705-236828	91637	Type MFF-1/8	3		I
R4	J2-P4	Res, comp, 22k ±5%, 1/4w	4704-148130	01121	CB2235	3		
R5	J3-P5	Res, comp, 22k ±5%, 1/4w	4704-148130	01121	CB2235	REF		
R6	J2-Q2	Res, comp, 200Ω ±5%, 1/4w	4704-193482	01121	CB2015	1		
R7	K2-N5	Res, comp, 47Ω ±5%, 1/4w	4704-147892	01121	CB4705	1		
R8	K3-Q1	Res, comp, 68k ±5%, 1/4w	4704-148171	01121	CB6835	REF		H
R8	K3-Q1	Res, met flm, 68.1k ±1%, 1/8w	4705-236828	91637	Type MFF-1/8	REF		I
R9	K4-Q5	Res, comp, 220Ω ±5%, 1/4w	4704-147959	01121	CB2215	1		
R10	J2-N3	Res, comp, 68k ±5%, 1/4w	4704-148171	01121	CB6835	REF		H
R10	J2-N3	Res, met flm, 68.1k ±1%, 1/8w	4705-236828	91637	Type MFF-1/8	REF		I
R11	J2-P1	Res, comp, 82k ±5%, 1/4w	4704-188458	01121	CB8235	2		H
R11	J2-P1	Res, met flm, 82.5k ±1%, 1/8w	4705-246223	91637	Type MFF-1/8	1		I
R12	I5-P2	Res, var, ww, 10k ±20%, 1-1/4w	4702-112862	71450	Type 110	4		
R13		Not used						
R14	I1-Q1	Res, met flm, 1.10k ±1%, 1/8w	4705-241497	75042	Type CEA-TO	1		
R15	I2-P3	Res, comp, 1M ±5%, 1/4w	4704-182204	01121	CB1055	4		
R16	I2-P5	Res, met flm, 9.76k ±1%, 1/8w	4705-241489	75042	Type CEA-TO	1		
R17	H5-P3	Res, var, ww, 6k ±5%, 1-1/4w	4702-113209	71450	Type 110	1		
R18	H2-Q4	Res, met flm, 100Ω, matched (not illustrated)	2					
R19, R20		Not used						
R21	D5-N4	Res, comp, 1M ±5%, 1/4w	4704-182204	01121	CB1055	REF		
R22	C3-N4	Res, comp, 2.2M ±5%, 1/4w	4704-198390	01121	CB2255	2		
R23	D2-P4	Res, comp, 4.7M ±5%, 1/4w	4704-220046	01121	CB4755	3		

REF DESIG	INDEX NO	DESCRIPTION	STOCK NO	MFR	MFR PART NO	TOT QTY	REC QTY	USE CODE
R24	D1-R1	Res, comp, 1M ±5%, 1/4w	4704-182204	01121	CB1055	REF		
R25	D2-R2	Res, comp, 1M ±5%, 1/4w	4704-182204	01121	CB1055	REF		
R26	D3-R1	Res, comp, 47k ±5%, 1/4w	4704-148163	01121	CB4735	2		
R27	D4-R1	Res, comp, 10k ±5%, 1/4w	4704-148106	01121	CB1035	2		
R28	D2-S1	Res, comp, 1.5k ±5%, 1/4w	4704-148031	01121	CB1525	2		
R29		Not used						
R30	D3-R2	Res, comp, 2.2M ±5%, 1/4w	4704-198390	01121	CB2255	REF		
R31	E5-R3	Res, comp, 2.4k ±5%, 1/4w	4704-193433	01121	CB2425	1		
R32	E5-T2	Res, var, ww, 10k ±20%, 1-1/4w	4702-112862	71450	Type 110	REF		
R33	D5-T4	Res, var, ww, 10k ±20%, 1-1/4w	4702-112862	71450	Type 110	REF		
R34	F3-Q5	Res, var, ww, 2k ±5%, 1-1/4w	4702-160705	71450	Type 110	1		
R35	E4-R3	Res, comp, 3.9k ±5%, 1/4w	4704-148064	01121	CB3925	1		
R36	G5-P5	Res, car flm, 8.2k ±1%, 1/2w	4703-107243	75042	Type C12	1		
R37 thru R39		Not used						
R40	E5-P4	Res, car flm, 10k ±1%, 1/2w	4703-107128	75042	Type C12	1		
R41	E2-Q2	Res, comp, 10Ω ±5%, 1/4w	4704-147868	01121	CB1005	2		
R42	E2-Q3	Res, comp, 82k ±5%, 1/4w	4704-188458	01121	CB8235	1		
R43	E1-R4	Res, comp, 3.3k ±5%, 1/4w	4704-148056	01121	CB3325	2		
R44	D5-R2	Res, comp, 4.7M ±5%, 1/4w	4704-220046	01121	CB4755	REF		
R45	D3-N5	Res, comp, 4.7M ±5%, 1/4w	4704-220046	01121	CB4755	REF		
R46	C5-S5	Res, var, ww, 6k ±5%, 1-1/4w	4702-113209	71450	Type 110	REF		
R47	C3-R5	Res, met flm, 22.1k ±1%, 1/8w	4705-235234	75042	Type CEA-TO	1		
R48	C5-R3	Res, met flm, 309k ±1%, 1/8w	4705-235283	75042	Type CEA-TO	1		
R49		Not used						
R50	C5-S1	Res, met flm, 27.4k ±1%, 1/8w	4705-241471	75042	Type CEA-TO	4		
R51	C3-S1	Res, comp, 120k ±5%, 1/4w	4704-193458	01121	CB1245	1		
R52	C4-S2	Res, comp, 22k ±5%, 1/4w	4704-148130	01121	CB2235	REF		A
R52	C4-S2	Res, met flm, 21.5k ±1%, 1/8w	4705-168278	75042	Type CEA-TO	1		B
R53	C1-T1	Res, comp, 27k ±5%, 1/4w	4704-148148	01121	CB2735	1		A
R53	C1-T1	Res, met flm, 27.4k ±1%, 1/8w	4705-241471	75042	Type CEA-TO	REF		B
R54	E2-S5	Res, comp, 22k ±5%, 1/4w	4704-148130	01121	CB2235	REF		
R55		Not used						
R56	G4-S5	Res, met flm, 27.4k ±1%, 1/8w	4705-241471	75042	Type CEA-TO	REF		
R57	H1-T3	Res, met flm, 27.4k ±1%, 1/8w	4705-241471	75042	Type CEA-TO	REF		
R58	D1-S1	Res, met flm, 10.5k ±1%, 1/8w	4705-234096	75042	Type CEA-TO	1		
R59	D1-S1	Res, met flm, 14.7k ±1%, 1/8w	4705-226225	75042	Type CEA-TO	1		
R60	G1-P3	Res, var, ww, 5Ω ±20%, 1-1/4w	4702-166348	71450	Type 110	1		

REF DESIG	INDEX NO	DESCRIPTION	STOCK NO	MFR	MFR PART NO	TOT QTY	REC QTY	USE CODE
R61, R62		Not used						
R63	I2-S5	Res, comp, 10Ω ±5%, 1/4w	4704-147868	01121	CB1005	REF		
R64	J5-R2	Res, comp, 10k ±5%, 1/4w	4704-148106	01121	CB1035	REF		
R65	H5-R3	Res, comp, 1.5k ±5%, 1/4w	4704-148031	01121	CB1525	REF		
R66	J1-R2	Res, comp, 3.3k ±5%, 1/4w	4704-148056	01121	CB3325	REF		
R67	I4-S4	Res, met flm, 90.9k ±1%, 1/8w (853A-01 only) (not illustrated)	4705-223537	75042	Type CEA-TO	1		
R68	I1-S2	Res, met flm, 12.7k ±1%, 1/8w	4705-217448	75042	Type CEA-TO	1		
R69	H4-S3	Res, met flm, 42.2k ±1%, 1/8w	4705-221655	75042	Type CEA-TO	1		
R70	G4-R4	Res, selected and matched	1					
R71	I5-S4	Res, met flm, 130k ±1%, 1/8w	4705-221648	75042	Type CEA-TO	1		
R72	H3-S3	Res, comp, 15k ±5%, 1/4w	4704-148114	01121	CB1535	1		
R73	H5-S1	Res, selected and matched	1					
R74		Not used						
R75	G3-R2	Res, ww, 2k ±0.1%, 1/2w	4704-240911	01686	Type T2	1		
R76	F5-S4	Res, selected and matched	1					
R77	G5-R3	Res, selected and matched	1					
R78	G3-S1	Res, var, ww, 10k ±20%, 1-1/4w	4702-112862	71450	Type 110	REF		
R79		Not used						
R80	G1-S1	Res, selected and matched	1					
T1	G3-U3	Transformer, drive	5602-228684	89536	5602-228684	1		
T2	J2-T4	Transformer, power	5602-249219	89536	5602-249219	1		
		Shield, input (not illustrated)	3156-232587	89536	3156-232587	1		
		Transipad, nylon (not illustrated)	2814-225722	07047	10204N	4		

1 Q25, R70, R73, R76, R77, and R80 are a factory matched set. If one or more components require replacement, the entire set must be replaced. Order Reference Amplifier Set, part number 4710-240150.

2 R18 and A2R22 thru A2R25 are a factory matched set. If one or more resistors require replacement, the entire set must be replaced. Order AC Converter Resistor Set, part number 4710-228635.

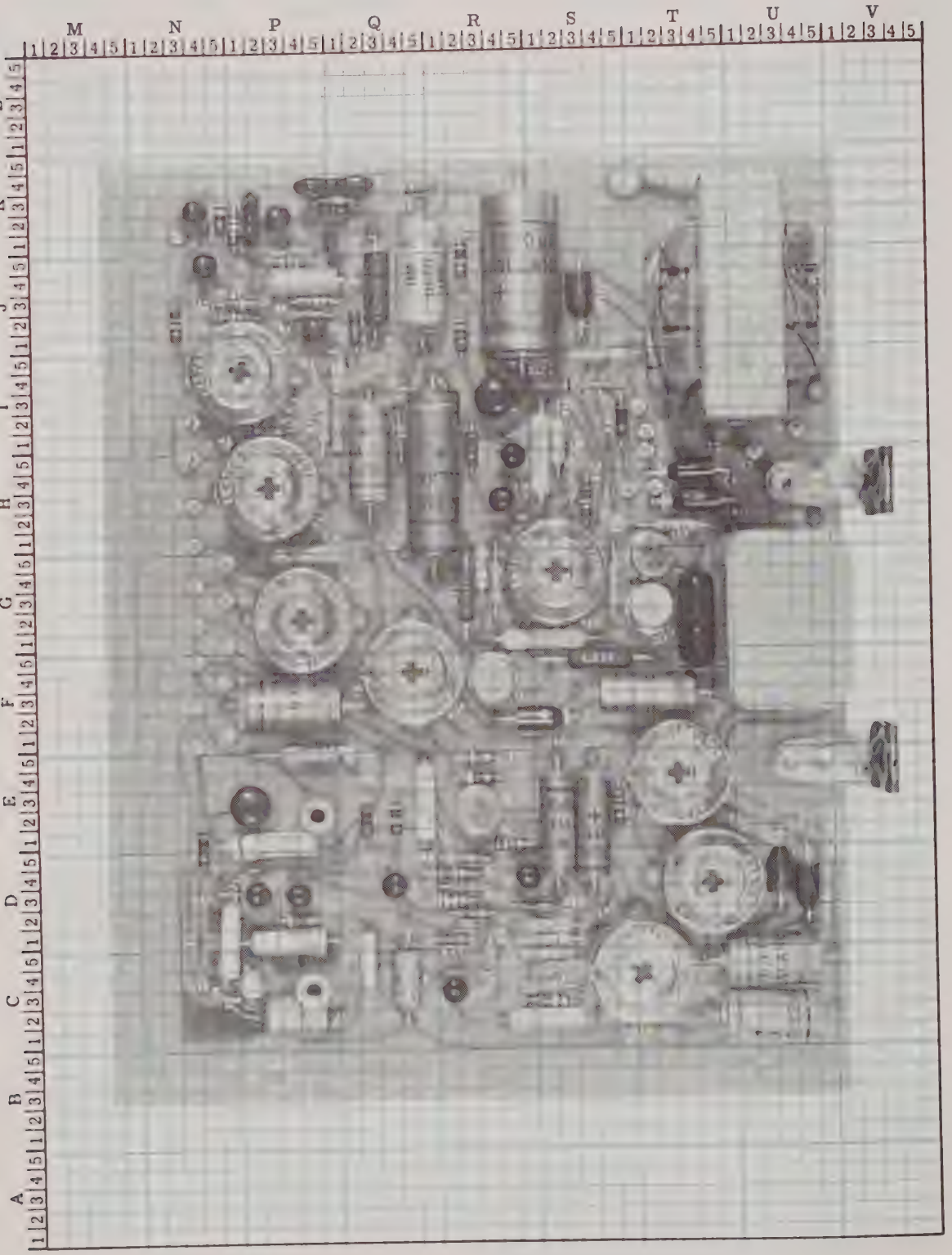


Figure 5-2. PRINTED CIRCUIT BOARD ASSEMBLY

REF DESIG	INDEX NO	DESCRIPTION	STOCK NO	MFR	MFR PART NO	TOT QTY	REC QTY	USE CODE
A2		**RANGE SWITCH ASSEMBLY Figure 5-3**	5110-228668 (853A-4628)	89536	5110-228668	REF		
C1	H2-S3	Cap, var, 1-8 pf, 1,000v	1509-195990	73899	ST853	1		
C2		Not used						
C3	K2-Q3	Cap, Ta, 2.2 uf ±20%, 20v	1508-161927	56289	196D225X-0020	1	1	
C4		Not used						
C5	J5-S5	Cap, var, 0.5-3 pf, 1,000v	1509-195982	73899	ST851	1		
C6	K1-T2	Cap, mica, 10 pf ±10%, 500v	1504-175216	88419	CD15C0100K	1		
CR1	F3-V1	Diode, silicon, 1 amp, 100 piv	4802-116111	05277	IN4817	REF		
CR2	F3-U4	Diode, silicon, 1 amp, 100 piv	4802-116111	05277	IN4817	REF		
F1		Fuse, Type GJV, fast acting, 2 amp, 250v (not illustrated)	5101-237313	71400	Type GJV	1	2	D
R1	H4-U5	Res, met flm, 4.5M, matched						
R2	H4-V1	Res, met flm, 4.5M, matched						
R3	H1-N3	Res, met flm, 900k, matched						
R4	H1-N4	Res, met flm, 90k, matched						
R5	H2-P1	Res, ww, 10k, matched						
R6		Res, comp, 100k ±5%, 1/4w (not illustrated)	4704-148189	01121	CB1045	1		J
R7 thru R9		Not used						
R10	I4-U3	Res, met flm, 24.3k ±1%, 1/8w	4705-236745	75042	Type CEA-TO	1		
R11	I4-U4	Res, met flm, 243k ±1%, 1/8w	4705-235242	75042	Type CEA-TO	1		
R12	I3-N3	Res, car flm, 2.80M ±0.5%, 1/2w	4703-220202	75042	Type C12	1		
R13	I4-N4	Res, met flm, 274k ±1%, 1/8w	4705-237297	75042	Type CEA-TO	1		
R14	I4-P1	Res, met flm, 27.4k ±1%, 1/2w	4705-237263	75042	Type CEC-TO	1		
R15 thru R19		Not used						
R20	H1-T1	Res, met flm, 97.6k ±1%, 1/8w	4705-241380	75042	Type CEA-TO	1		
R21	I2-S4	Res, var, comp, 5k ±30%, 1/4w	4701-183103	71450	Type X201	1		
R22	J4-T1	Res, met flm, 200k, matched						
R23	J5-T3	Res, met flm, 19.9k, matched						
R24	J5-T5	Res, met flm, 1.9k, matched						
R25	J5-U1	Res, met flm, 100Ω, matched						
R26	K3-S5	Res, comp, 47k ±5%, 1/4w	4704-148163	01121	CB4735	REF		
R27 thru R29		Not used						
R30	G3-T5	Res, ww, 0.1Ω ±0.1%, matched						
R31	F5-T3	Res, ww, 1.0Ω ±0.1%, matched						
R32	F4-S4	Res, ww, 10Ω ±0.1%, matched						
R33	F4-S2	Res, ww, 100.1Ω ±0.1%, matched						
R34	F4-S1	Res, ww, 1010Ω ±0.1%, matched						
R35	F4-U2	Res, comp, 270Ω ±5%, 1/4w	4704-160804	01121	CB2715	1		

REF DESIG	INDEX NO	DESCRIPTION	STOCK NO	MFR	MFR PART NO	TOT QTY	REC QTY	USE CODE
R36	G1-U2	Res, comp, 1Ω ±5%, 1/2w	4704-218693	01121	EB10G5	1		
R37 thru R39		Not used						
R40	E2-Q2	Res, met flm, 1k ±0.1%, 1/4w	4705-225813	91637	Type MFF-1/4	1		
R41	E3-S4	Res, ww, 9k, matched	3					
R42	E5-T3	Res, met flm, 90k, matched						
R43	E3-U1	Res, met flm, 900k, matched						
R44	E4-Q2	Res, met flm, factory selected and matched	4					
R45 thru R49		Not used						
R50	I5-Q1	Res, met flm, 1.02k ±1%, 1/8w	4705-223545	75042	Type CEA-TO	2		
R51	I5-Q3	Res, met flm, 93.1Ω ±1%, 1/8w	4705-237289	75042	Type CEA-TO	1		
R52	I3-Q3	Res, met flm, 806Ω ±1%, 1/8w	4705-223552	75042	Type CEA-TO	1		
R53	I4-T3	Res, met flm, 3.16k ±1%, 1/8w	4705-235291	75042	Type CEA-TO	1		
R54	I4-T1	Res, car flm, 90.9k ±0.5%, 1/2w	4703-220467	75042	Type C12	1		
S1	D1-T5	Switch, RANGE, rotary, 18 pos, 8 sect.	5105-228726	89536	5105-228726	1		

2 R22 thru R25 and A1R18 are a factory matched set. If one or more resistors require replacement, the entire set must be replaced. Order AC Converter Resistor Set, part number 4710-228635.

3 R1 thru R5 and R41 thru R43 are a factory matched set. If one or more resistors require replacement, the entire set must be replaced. Order Input Resistor Set, part number 4710-228627.

4 R30 thru R34 and R44 are a factory matched set. If a resistor requires replacement, give full reference designation, model and serial number, and all information stamped on the resistor when ordering.

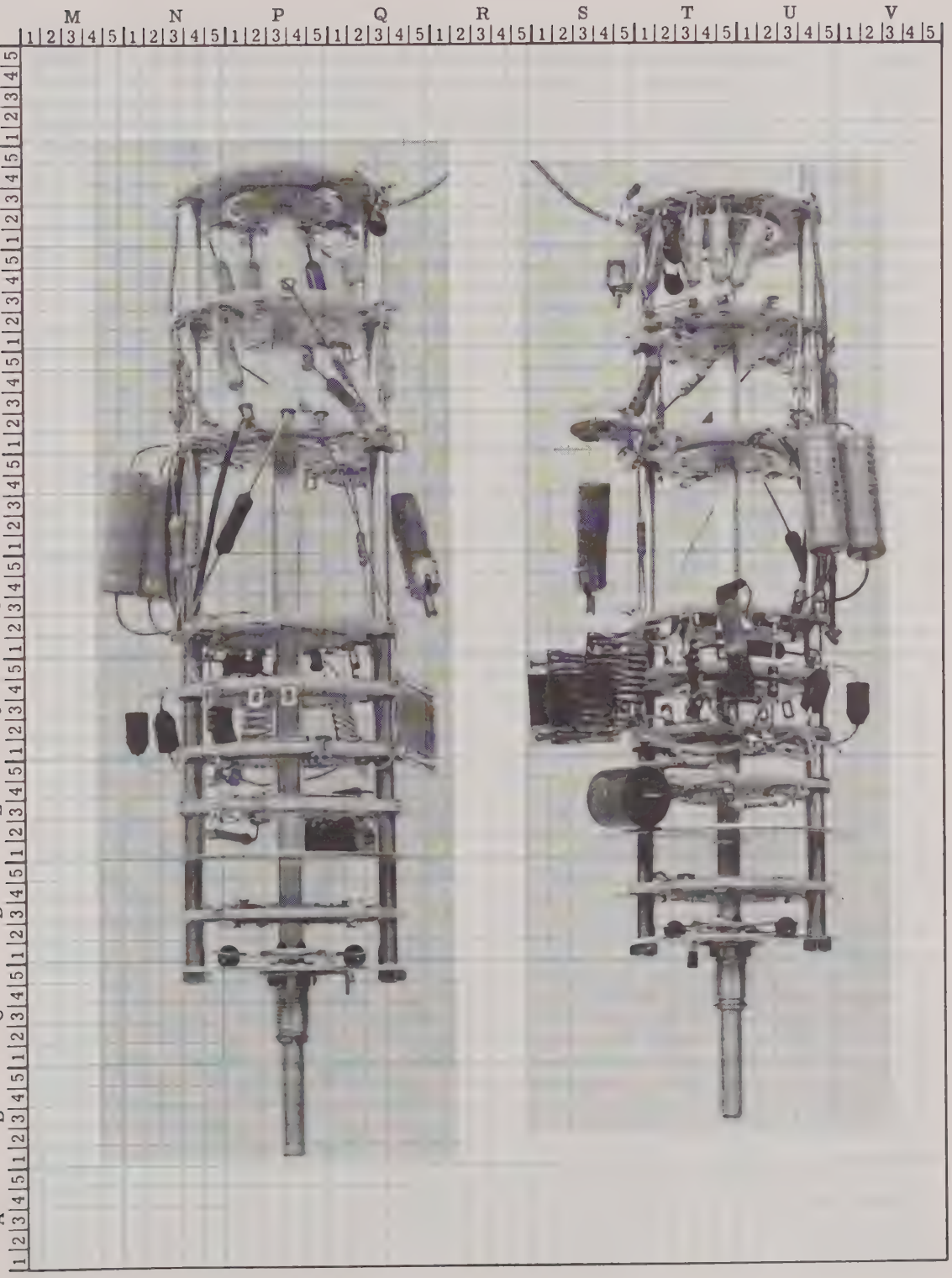


Figure 5-3. RANGE SWITCH ASSEMBLY

REF DESIG	INDEX NO	DESCRIPTION	STOCK NO	MFR	MFR PART NO	TOT QTY	REC QTY	USE CODE
A3		**MODE SWITCH ASSEMBLY** Figure 5-4	5110-228676 (853A-4629)	89536	5110-228676	REF		
C1	G3-S3	Cap, plstc, 0.22 uf ±20%, 1,200v	1507-220079	84411	JF-17	1		
C2 thru C4		Not used						
C5	G1-P3	Cap, plstc, 0.22 uf ±20%, 120v	1507-167452	84411	JF-39	1		
C6 thru C9		Not used						
C10	G3-U1	Cap, plstc, 1.0 uf ±20%, 200v	1507-106450	84411	Type X663F	1		
C11 thru C14		Not used						
C15	D5-U4	Cap, plstc, 0.047 uf ±20%, 1,200v	1507-182683	84411	JF-37	1		
R1 thru R4		Not used						
R5	E5-P1	Res, comp, 680k ±10%, 1/2w	4704-108340	01121	EB6841	1		
R6 thru R10		Not used						
R11	I5-P4	Res, met flm, 115k ±1%, 1/8w	4705-229153	75042	Type CEA-TO	2		F
R11	I5-P4	Res, met flm, 100k ±1%, 1/2w	4705-151316	75042	Type CEC-TO	1		G
R12	I4-P4	Res, met flm, 115k ±1%, 1/8w	4705-229153	75042	Type CEA-TO	1		
R13, R14		Not used						
R15	K2-T2	Res, var, comp, 1k ±10%, 1/2w	4701-225946	71450	M45-304475	1		
R16 thru R19		Not used						
R20	H5-U1	Res, met flm, 1.02k ±1%, 1/8w	4705-223545	75042	Type CEA-TO	REF		C
S2	C5-P5	Switch, MODE, rotary, 8 pos, 7 sect.	5105-228734	89536	5105-228734	1		

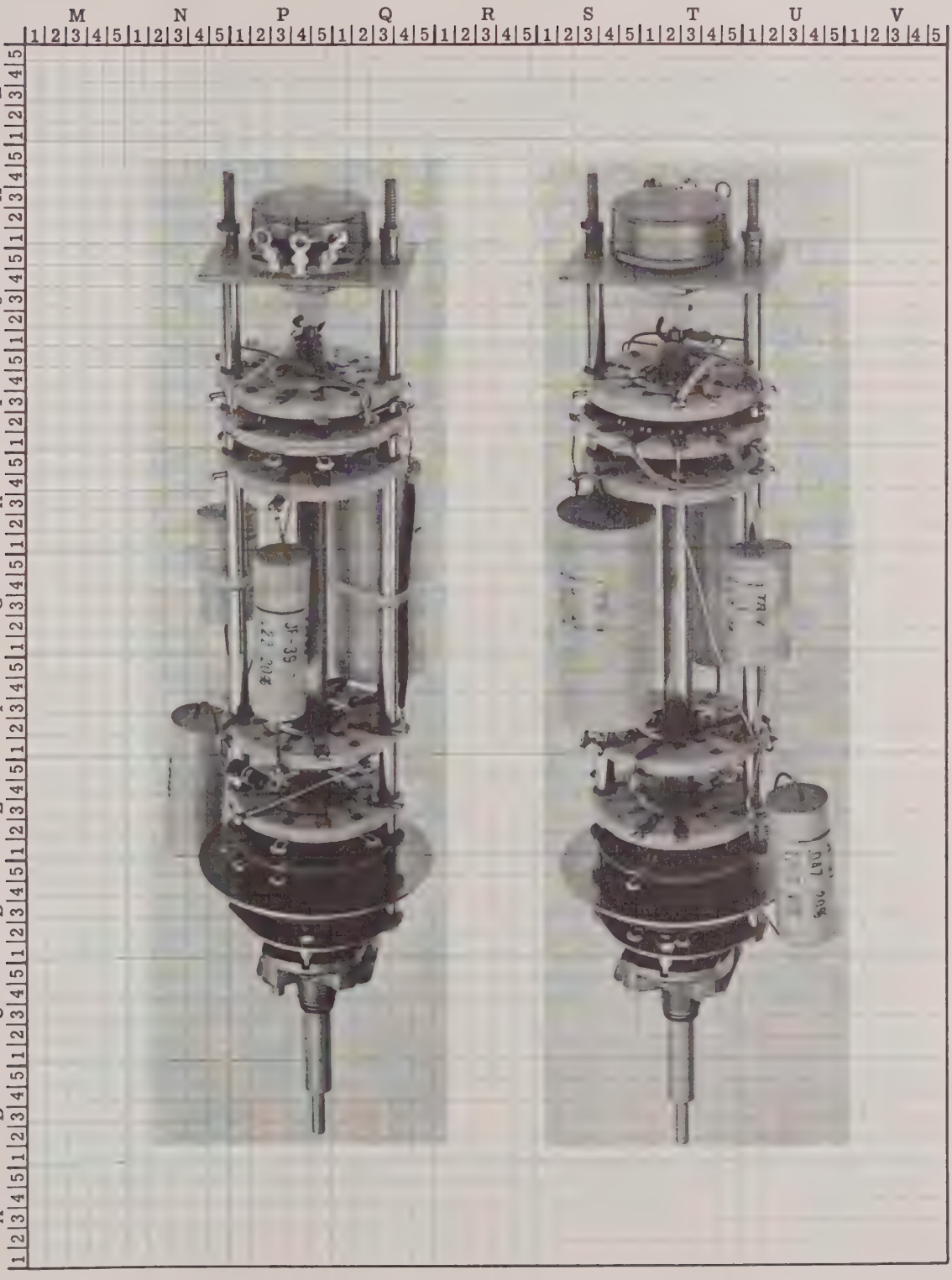


Figure 5-4. MODE SWITCH ASSEMBLY

REF DESIG	INDEX NO	DESCRIPTION	STOCK NO	MFR	MFR PART NO	TOT QTY	REC QTY	USE CODE
A4		**FINAL ASSEMBLY** **Figure 5-5**						
BT1		Battery, 22.5v, carbon (853A only) (not illustrated)	4002-245407	83740	Type 763	1		
BT1	G2-S1	Battery, 1.2v, Ni-Cad, (853A-01 only)	4002-160390	83740	Type C1.2T	11		
DS1	B5-P4	Lamp, incandescent, 28v (853A-01 only) (beneath dial)	3901-157636	71744	1820	1	1	
F1		Fuse, Type MDL, slow blow, 1/16 amp, 250v (115v operation) (not illustrated)	5101-163030	71400	Type MDL	1	2	
F1		Fuse, Type MDL, slow blow, 1/32 amp, 250v (230v operation) (not illustrated)	5101-163022	71400	Type MDL	1	2	
F2		Fuse, Type AGC, fast acting, 2 amp, 250v (not illustrated)	5101-109173	71400	Type AGC	1	2	E
M1	C1-T1	Meter, 0-100 ua, 600Ω	2901-236521	89536	2901-236521	1		
R1		Res, met flm, 1M ±1/10%, 2w (not illustrated)	4705-225953	91637	Type MFF-2	1		
R2 thru R9		Not used						
R10	D3-N5	Res, var, ww, 100Ω ±0.5%	4711-228544	89536	4711-228544	1		
W1	L1-S1	Line cord	6005-226027	89536	6005-226027	1		
XDS1	B5-P4	Holder, lamp (beneath dial)	2110-103523	72619	7-08	1		
XF1	J5-U1	Holder, fuse	2102-160846	75915	342004	1		
XF2		Holder, fuse (not illustrated)	2102-103283	71400	4405	1		E
	G1-S5	Bracket, battery	3156-232603	89536	3156-232603	1		
	L1-N3	Casting, side, rear	3151-231548	89536	3156-231548	2		
		Cover, bottom (not illustrated)	3156-230243	89536	3156-230243	1		
		Cover, top (not illustrated)	3156-230235	89536	3156-230235	1		
		Dial, on/off power indicator (not illustrated)	2403-228593	89536	2403-228593	1		
	B5-N5	Dial, O-X	2403-242859	89536	2403-242859	1		
	B5-P5	Dial, O-X	3158-232645	89536	3158-232645	1		
	B5-Q4	Dial, .0-1.0	3158-232637	89536	3158-232637	1		
	I4-N4	Foot	3155-230037	89536	3155-230037	4		
	A4-R4	Handle, carrying	2906-231431	89536	2906-231431	1		
	F4-S1	Holder, battery (853A-01 only)	3155-239640	89536	3155-239640	2		
	K1-P1	Panel, rear	3158-228510	89536	3158-228510	1		
		Trim strip, front (not illustrated)	3154-230797	89536	3154-230797	2		
	H3-Q3	Trim strip, rear	3151-230805	89536	3151-230805	2		
	K3-N3	Trim strip, side center	3155-230912	89536	3155-230912	2		

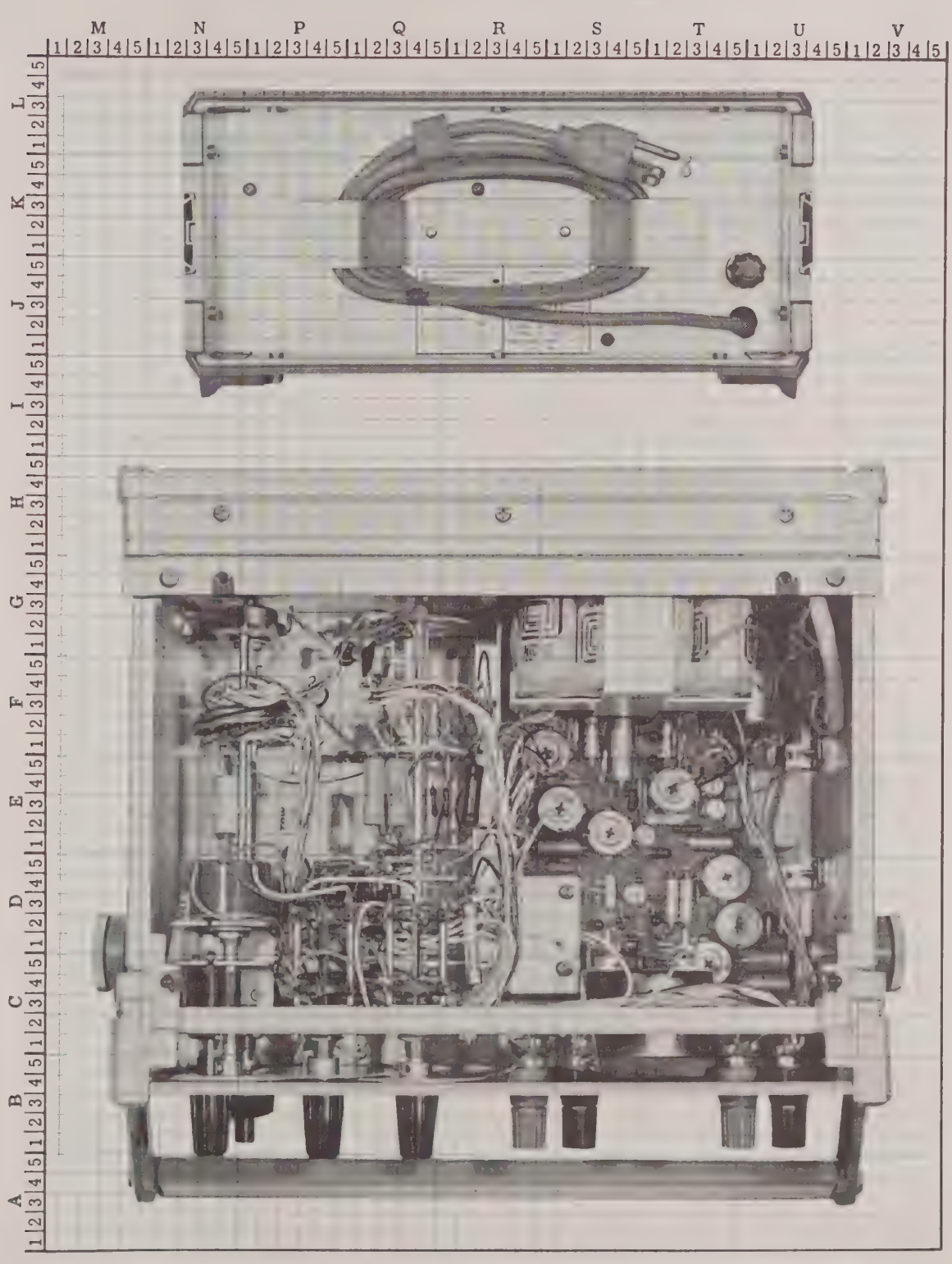


Figure 5-5. FINAL ASSEMBLY

REF DESIG	INDEX NO	DESCRIPTION	STOCK NO	MFR	MFR PART NO	TOT QTY	REC QTY	USE CODE
A5		**DECADE POTENTIOMETER, DECK "A" ASSEMBLY Figure 5-6**	5110-228643 (853A-4612)	89536	5110-228643	REF		
R1	I5-Q5	Res, ww, 2k ±0.1%, 1w	4707-243048	01686	Type T2A	6		
R2	K1-Q5	Res, ww, 2k ±0.1%, 1w	4707-243048	01686	Type T2A	REF		
R3	K4-Q2	Res, ww, 2k ±0.1%, 1w	4707-243048	01686	Type T2A	REF		
R4	J4-P5	Res, ww, 2k ±0.1%, 1w	4707-243048	01686	Type T2A	REF		
R5	I4-Q1	Res, ww, 2k ±0.1%, 1w	4707-243048	01686	Type T2A	REF		
R6		Res, ww, 2k ±0.1%, 1w (located opposite side of deck 2)	4707-243048	01686	Type T2A	REF		
R7 thru T10		Not used						
R11	I4-T1	Res, ww, 2k ±0.03%, 1w	4707-243030	01686	Type T2A	6		
R12	J4-S5	Res, ww, 2k ±0.03%, 1w	4707-243030	01686	Type T2A	REF		
R13	J4-S2	Res, ww, 2k ±0.03%, 1w	4707-243030	01686	Type T2A	REF		
R14	J3-S1	Res, ww, 2k ±0.03%, 1w	4707-243030	01686	Type T2A	REF		
R15	I4-R5	Res, ww, 2k ±0.03%, 1w	4707-243030	01686	Type T2A	REF		
R16		Res, ww, 2k ±0.03%, 1w (located opposite side of deck 1)	4707-243030	01686	Type T2A	REF		
S3	J2-Q4	Switch, DECK "A", rotary, 11 pos, 2 sect.	5105-226373	89536	5105-226373	2		
A6		**DECADE POTENTIOMETER, DECK "B" ASSEMBLY Figure 5-6**	5110-228650 (853A-4613)	89536	5110-228650	REF		
R1	F4-Q5	Res, met flm, 200Ω ±1%, 1/8w ⑤	4705-245340	75042	Type CEA-TO	6		
R2	G5-Q5	Res, met flm, 200Ω ±1%, 1/8w ⑤	4705-245340	75042	Type CEA-TO	REF		
R3	H3-Q2	Res, met flm, 200Ω ±1%, 1/8w ⑤	4705-245340	75042	Type CEA-TO	REF		
R4	G3-P5	Res, met flm, 200Ω ±1%, 1/8w ⑤	4705-245340	75042	Type CEA-TO	REF		
R5	F4-Q1	Res, met flm, 200Ω ±1%, 1/8w ⑤	4705-245340	75042	Type CEA-TO	REF		
R6		Res, met flm, 200Ω ±1%, 1/8w (located opposite side of deck 2) ⑤	4705-245340	75042	Type CEA-TO	REF		
R7 thru R10		Not used						
R11	F3-S5	Res, ww, 200Ω ±0.1%, 1w	4707-240929	01686	Type T2A	6		
R12	G4-T1	Res, ww, 200Ω ±0.1%, 1w	4707-240929	01686	Type T2A	REF		

REF DESIG	INDEX NO	DESCRIPTION	STOCK NO	MFR	MFR PART NO	TOT QTY	REC QTY	USE CODE
R13	G4-S2	Res, ww, 200Ω ±0.1%, 1w	4707-240929	01686	Type T2A	REF		
R14	G3-S1	Res, ww, 200Ω ±0.1%, 1w	4707-240929	01686	Type T2A	REF		
R15	F4-S1	Res, ww, 200Ω ±0.1%, 1w	4707-240929	01686	Type T2A	REF		
R16		Res, ww, 200Ω ±0.1%, 1w (located opposite side of deck 1)	4707-240929	01686	Type T2A	REF		
S4	G1-Q4	Switch, DECK "B", rotary, 11 pos, 2 sect.	5105-226373	89536	5105-226373	REF		

5 R1 thru R6 may be substituted with wirewound resistors, Fluke Part No. 4707-240929.

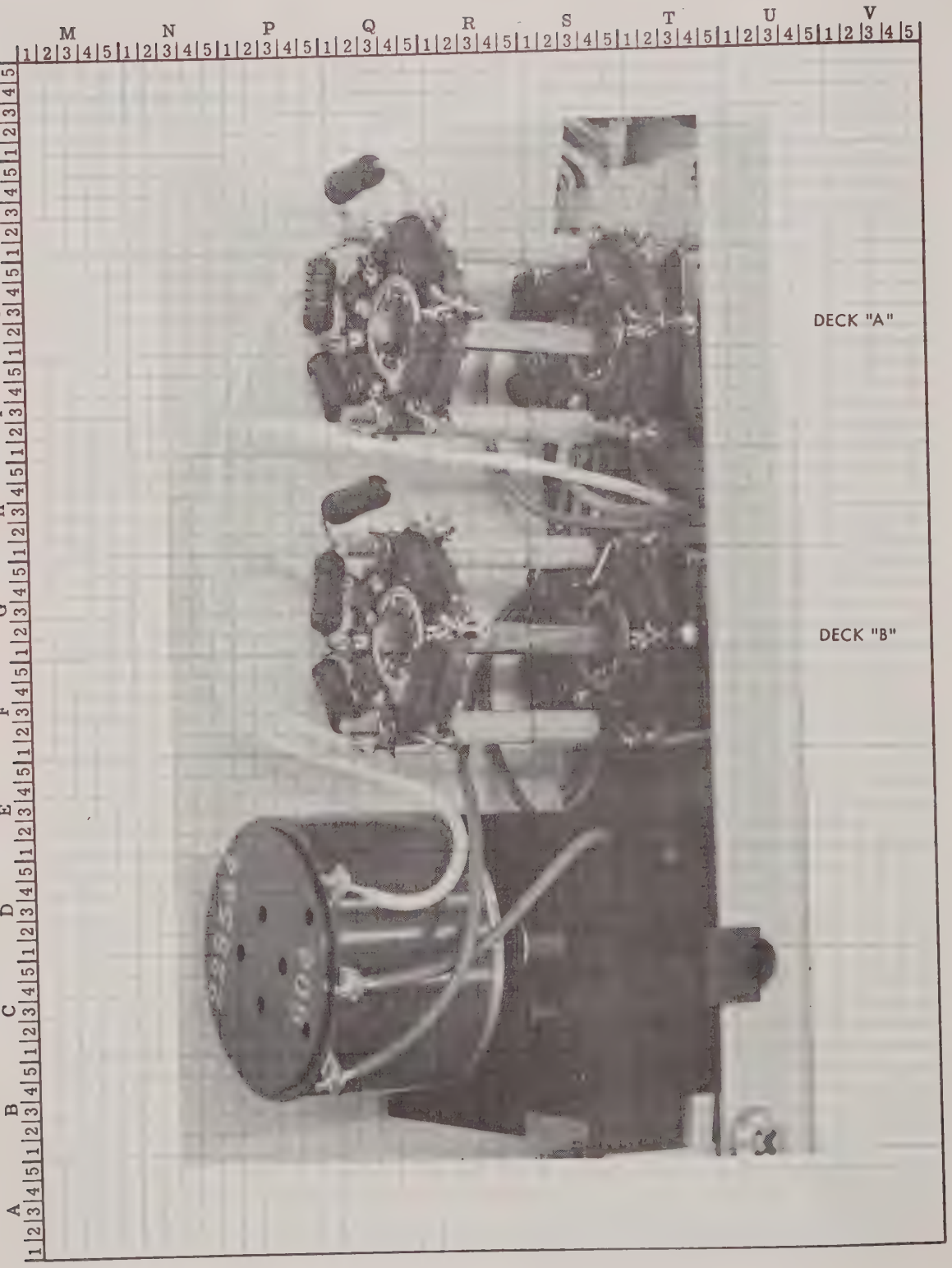


Figure 5-6. DECADE POTENTIOMETER, DECK "A" AND "B" ASSEMBLIES

REF DESIG	INDEX NO	DESCRIPTION	STOCK NO	MFR	MFR PART NO	TOT QTY	REC QTY	USE CODE
A7		**FRONT PANEL ASSEMBLY Figure 5-7**						
J1	C5-I1	Binding post, red, + INPUT	2811-142976	58474	DF31RC	2		
J2	C5-H3	Binding post, black, - INPUT	2811-142984	58474	DF31BC	2		
J3	C5-K1	Binding post, red, 10 AMP + INPUT	2811-142976	58474	DF31RC	REF		
J4	C5-J4	Binding post, black, 10 AMP - INPUT	2811-142984	58474	DF31BC	REF		
R1		Res, ww, shunt, 0.0101Ω ±0.75%, 1w (mounted to J3 and J4)	4707-224113	89536	4707-224113	1		
	F1-G5	Casting, side, front	3151-231530	89536	3151-231530	2		
	C5-L2	Knob, DIGIT	2405-158949	89536	2405-158949	3		
		Knob, MODE						
	E1-M5	Knob, bar	2405-162347	89536	2405-162347	1		
	E1-N1	Knob, vernier	2405-241018	89536	2405-241018	1		
	E1-N2	Knob, trim disc	2405-236950	89536	2405-236950	1		
	E1-L2	Knob, RANGE	2405-158956	89536	2405-158956	1		
	E4-M1	Lens, decimal light	3155-103440	89536	3155-103440	1		
	C3-K3	Panel, front	3156-232512	89536	3156-232512	1		

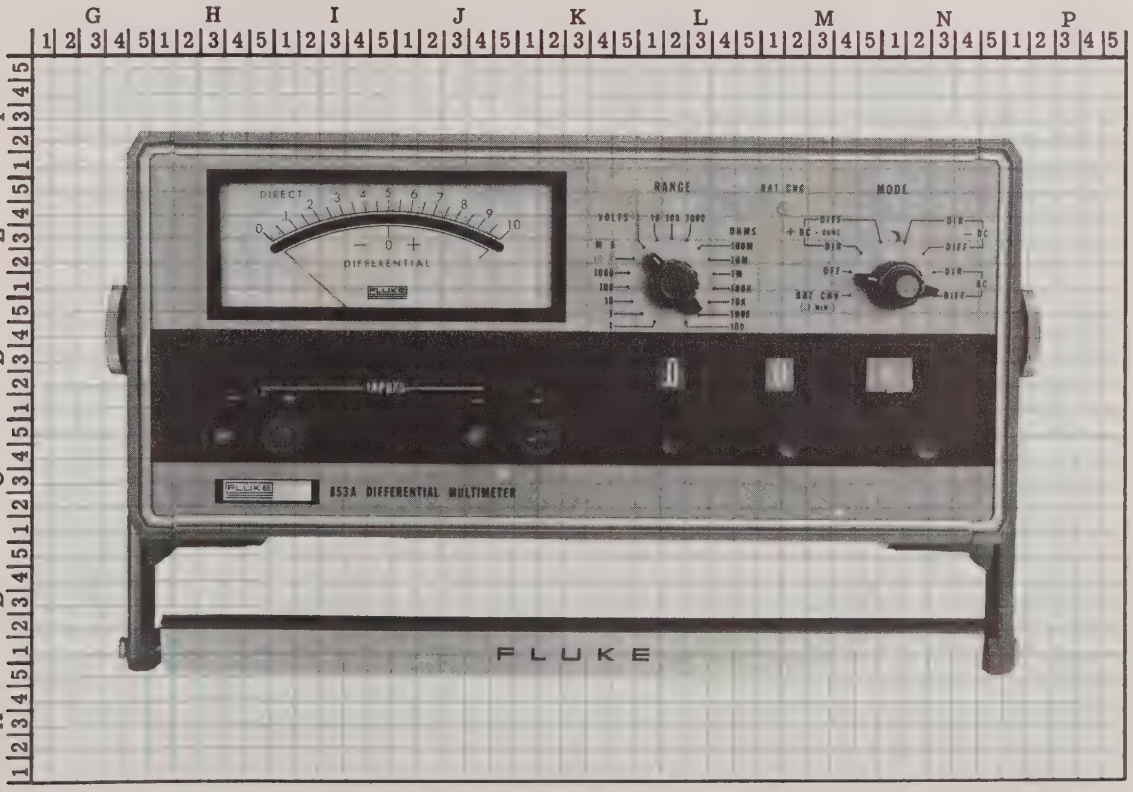


Figure 5-7. FRONT PANEL ASSEMBLY

5-8. SERIAL NUMBER EFFECTIVITY

5-9. A Use Code column is provided to identify certain parts that have been added, deleted, or modified during production of the Model 853A. Each part for which a use code has been assigned may be identified with a particular instrument serial number by consulting the Use Code Effectivity List below. All parts with no code are used on all instruments with serial numbers above 123. New codes will be added as required by instrument changes.

USE CODE	EFFECTIVITY
No Code	Model 853A and 853A-01, serial number 123 and on.
A	Model 853A and 853A-01, serial number 123 thru 147.
B	Model 853A and 853A-01, serial number 148 and on.
C	Model 853A and 853A-01, serial number 148 thru 152, 154, 155, 157, 158, 160, 162 thru 177, 179, 181 thru 188, 190 thru 192, 195 thru 207, 209 and on.
D	Model 853A and 853A-01, serial number 123 thru 547.
E	Model 853A and 853A-01, serial number 548 and on.
F	Model 853A and 853A-01, serial number 123 thru 647.
G	Model 853A and 853A-01, serial number 648 and on.
H	Model 853A and 853A-01, serial number 123 thru 842 and 848 thru 857.
I	Model 853A and 853A-01, serial number 843 thru 847 and 858 and on.
J	Model 853A and 853A-01, serial number 903, 913, 923, 938, and on.

SECTION VI

ACCESSORY AND OPTION INFORMATION

6-1. INTRODUCTION

6-2. This section of the manual contains information pertaining to the accessories and options available for your instrument.

6-3. ACCESSORY INFORMATION

6-4. The accessory information, if applicable, will contain details concerning accessories that may be used with this particular instrument.

6-5. OPTION INFORMATION

6-6. Each of the options available for this instrument, if any, are described separately under headings containing the option number. The option descriptions contain applicable operating and maintenance instructions and field installation procedures. A complete list of replaceable parts for each option is contained at the end of that option description.

OPTION INFORMATION

RECHARGEABLE BATTERY PACK (OPTION-01) FOR THE MODEL 853A DIFFERENTIAL MULTIMETER

6-1. INTRODUCTION

6-2. The Model 853A Differential Multimeter disposable carbon battery can be replaced with a rechargeable nickle-cadmium battery pack by installation of the 853A-7001 Option Kit illustrated in Figure 1. Upon installation of this option kit the Model 853A is redesignated a Model 853A-01 by a rear panel decal marking.

Figure 1. THE 853A-7001 OPTION KIT

6-3. INSTALLATION PROCEDURE

6-4. The equipment necessary to install the 853A-7001 Option Kit are a 40 watt soldering iron, noncorrosive solder, and a pair of electricians pliers. To install the option kit, proceed as follows:

a. Remove the upper and lower dust covers from the Model 853A.

b. Place the instrument bottom-side-up and disconnect the red and black battery wires from terminals 23 and 25 of the printed circuit board. Wrap each connector of the red and black wires with tape to prevent discharging of the battery.

c. Remove the rear panel battery holder screws which secure the carbon battery to the rear panel assembly and remove the battery and holder from the instrument.

d. Install the 90.9k resistor supplied in the option kit in the existing R67 holes of the printed circuit board. Refer to Figure 2 for the location of this resistor.

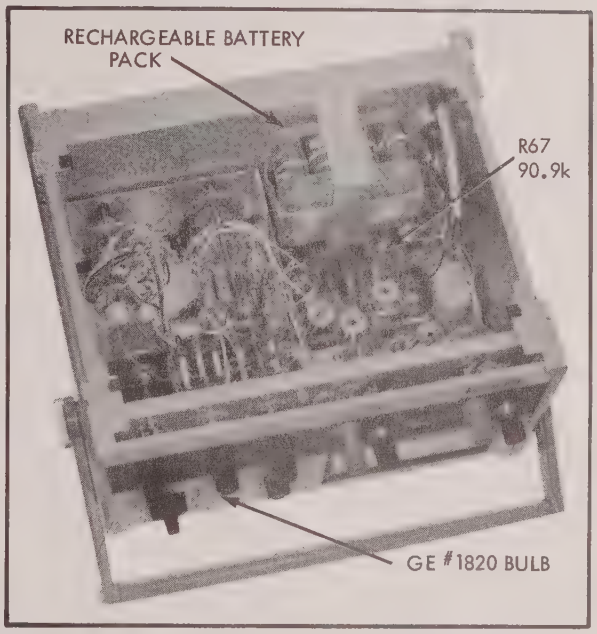


Figure 2. OPTION KIT COMPONENT LOCATIONS

e. Turn the Model 853A over and solder the resistor leads to the circuit side of the printed circuit board. Cut off any excess resistor lead after soldering is completed.

f. Locate the front panel charge light socket and install the GE #1820 bulb supplied in the option kit. Refer to Figure 2 for the location of this light socket.

g. Replace the upper dust cover and turn the instrument over.

h. Install the rechargeable battery pack supplied in the option kit on the rear panel assembly using the battery holder and screws removed in step c. Refer to Figure 2 for correct positioning of the battery pack which will allow the red and black wires to reach the appropriate terminals of the printed circuit board.

i. Remove the tape from the connector of the battery pack's black wire and connect the wire to terminal 25 of the instrument's printed circuit board.

j. Remove the tape from the connector of the battery pack's red wire and connect the wire to terminal 23 of the instrument's printed circuit board.

k. Replace the lower dust cover and place an X on the rear panel decal adjacent to RECHARGEABLE BATTERIES-01.

l. Hold the MODE switch to the BAT CHK position, observing the deflection of the front panel meter. If the meter indicates .2 or above, the batteries are adequately charged and the instrument can be operated on battery power. Should the meter indicate less than .2, the batteries must be recharged by operating the instrument from line power until the batteries pass the BAT CHK test.

6-5. PARTS LIST

DESIG.	DESCRIPTION	FLUKE STOCK NO.
BT1	Battery Pack, Rechargeable	4005-239665
DS1	Lamp, minature bayonet, 28V, Type 1820	3901-157636
R67	Resistor, comp, 90.9k ± 1%, 1/8 W	4705-223537

APPENDIX A

FEDERAL SUPPLY CODE FOR MANUFACTURERS

A-1. CODE TO NAME

A-2. The following five-digit code numbers are listed in numerical sequence along with the manufacturer's name and address to which the code has been assigned. The Federal Supply Code has been taken from Cataloging Handbook H 4-2, Code to Name.

00213 Sage Electronics Corp.
Rochester, New York

00327 Welwyn International, Inc.
Westlake, Ohio

00656 Aerovox Corp
New Bedford, Massachusetts

00779 AMP Inc.
Harrisberg, Pennsylvania

01121 Allen-Bradley Co.
Milwaukee, Wisconsin

01281 TRW Semiconductors
Lawndale, California

01295 Texas Instruments, Inc.
Semiconductor Components Div.
Dallas, Texas

01686 RCL Electronics Inc.
Manchester, New Hampshire

01730 Deleted

01884 Dearborn Electronics Inc.
Orlando, Florida

02114 Ferroxcube Corp
Saugerties, New York

02606 Replaced by 15801

02660 Amphenol-Borg Elect. Corp.
Broadview, Illinois

02799 Arco Capacitors, Inc.
Los Angeles, California

03614 Replaced by 71400

03651 Replaced by 44655

03797 Eldema Corp.
Compton, California

03877 Transitron Electronic Corp.
Wakefield, Massachusetts

03888 Pyrofilm Resistor Co., Inc.
Cedar Knolls, New Jersey

03911 Clairex Corp.
New York, New York

03980 Murrhead Instruments, Inc.
Mountainside, New Jersey

04009 Arrow Hart and Hegemen
Electronic Company
Hartford, Connecticut

04062 Replaced by 72136

04202 Replaced by 81312

04217 Essex Wire Corp
Wire & Cable Div.
Anaheim, California

04221 Aemco
Div. of Midtex Inc.
Mankato, Minnesota

04645 Replaced by 75376

04713 Motorola Semiconductor Products Inc.
Phoenix, Arizona

05082 Replaced by 94154

05236 Jonathan Mfg. Co.
Fullerton, California

05277 Westinghouse Electric Corp.
Semiconductor Dept.
Youngwood, Pennsylvania

05278 Replaced by 43543

05397 Union Carbide Corp.
Electronics Div.
Cleveland, Ohio

05571 Sprague Electric Co
Pacific Div.
Los Angeles, California

05704 Alac, Inc.
Glendale, California

05820 Wakefield Engineering Ind.
Wakefield, Massachusetts

06001 General Electric Company
Capacitor Department
Irmo, South Carolina

06136 Replaced by 63743

06473 Amphenol Space & Missile Sys.
Chatsworth, California

06555 Beede Electrical Instrument Co.
Penacook, New Hampshire

06739 Electron Corp.
Littletown, Colorado

06743 Clevite Corp.
Cleveland, Ohio

06751 Semcor Div. Components
Phoenix, Arizona

06860 Gould National Batteries Inc.
City of Industry, California

06980 Eitel-McCullough, Inc.
San Carlos, California

07115 Replaced by 14674

07138 Westinghouse Electric Corp
Electronic Tube Div.
Elmira, New York

07263 Fairchild Semiconductor
Div. of Fairchild Camera
& Instrument Corp.
Mountain View, California

07344 Bircher Co., Inc.
Rochester, New York

07792 Lerma Engineering Corp
Northampton, Massachusetts

07910 Continental Device Corp.
Hawthorne, California

08530 Reliance Mica Corp.
Brooklyn, New York

08792 CBS Electronics Semiconductor
Operations-Div. of CBS Inc.
Lowell, Massachusetts

08806 General Electric Co.
Miniature Lamp Dept.
Cleveland, Ohio

08863 Nylomatic Corp.
Norrisville, Pennsylvania

08988 Skottie Electronics Inc.
Archbald, Pennsylvania

09922 Burndy Corp.
Norwalk, Connecticut

11237 Chicago Telephone of Calif. Inc.
South Pasadena, California

11358 CBS Electronics
Div. of CBS Inc.
Newburyport, Massachusetts

11403 Best Products Co.
Chicago, Illinois

11503 Keystone Mfg
Div. of Avis Industrial Corp.
Warren, Michigan

12014 Chicago Rivet & Machine Co.
Bellwood, Illinois

12040 National Semiconductor Corp.
Danburry, Connecticut

12060 Diodes, Inc.
Chatsworth, California

12136 Philadelphia Handle Co.
Camden, New Jersey

12323 Presin Co., Inc.
Shelton, Connecticut

12327 Freeway Washer & Stamping Co.
Cleveland, Ohio

12400 Replaced by 75042

12617 Hamlin Inc.
Lake Mills, Wisconsin

12697 Clarostat Mfg. Co.
Dover, New Hampshire

12749 James Electronics
Chicago, Illinois

12856 Micrometals
Sierra Madre, California

12954 Dickson Electronics Corp.
Scottsdale, Arizona

13606 Sprague Electric Co.
Transistor Div.
Concord, New Hampshire

13839 Replaced by 23732

14099 Semtech Corp.
Newbury Park, California

14193 California Resistor Corp.
Santa Monica, California

14298 American Components, Inc.
Conshohocken, Pennsylvania

14655 Cornell-Dubilier Electronics
Newark, New Jersey

14674 Corning Glass Works
Corning, New York

14752 Electro Cube Inc.
San Gabriel, California

14869 Replaced by 96853

15636 Elec-Trol Inc.
Northridge, California

15801 Fenwal Electronics Inc.
Framingham, Massachusetts

15818 Amelco Semiconductor
Div. of Teledyne Inc.
Mountain View, California

15849 Useco, Inc.
Mt. Vernon, New York

15909 Replaced by 17870

16332 Replaced by 28478

16473 Cambridge Scientific Ind. Inc.
Cambridge, Maryland

16742 Paramount Plastics
Downey, California

16758 Delco Radio
Div. of General Motors
Kokomo, Indiana

17069 Circuit Structures Lab.
Upland, California

17856 Siliconix, Inc.
Sunnyvale, California

17870 Daven-Div. of Thomas A. Edison
Ind. --McGraw-Edison Co.
Manchester, New Hampshire

18083 Deleted

18178 Vactec Inc.
Maryland Heights, Missouri

18736 Voltronics Corp.
Hanover, New Jersey

19429 Montronics, Inc.
Seattle, Washington

19451 Perine Machinery & Supply Co.
Seattle, Washington

19701 Electra Mfg. Co.
Independence, Kansas

20584 Enochs Mfg. Co.
Indianapolis, Indiana

22767 ITT Semiconductors
Div. of ITT
Palo Alto, California

23732 Tracor
Rockville, Maryland

24248 Southco
Div. of South Chester Corp.
Lester, Pennsylvania

24655 General Radio Co.
West Concord, Massachusetts

25403 Amperex Electronic Corp
Semiconductor & Receiving
Tube Division
Slatersville, Rhode Island

28478 Deltrol Controls Corp.
Milwaukee, Wisconsin

28520 Heyman Mfg. Co.
Kenilworth, New Jersey

30323 Illinois Tool Works Inc.
Chicago, Illinois

33173 General Electric Co.
Tube Dept.
Owensboro, Kentucky

37942 Mallory, P. R., & Co., Inc.
Indianapolis, Indiana

38315 Honeywell Inc.
Precision Meter Div.
Manchester, New Hampshire

42498 National Company
Melrose, Massachusetts

43543 Nytronics Inc.
Transformer Co. Div.
Alpha, New Jersey

44655 Ohmite Mfg. Co.
Skokie, Illinois

49671 Radio Corp. of America
New York, New York

49956 Raytheon Company
Lexington, Maine

53021 Sangamo Electric Co.
Springfield, Illinois

55026 Simpson Electric Company
Chicago, Illinois

56289 Sprague Electric Co.
North Adams, Massachusetts

58474 Superior Electric Co.
Bristol, Connecticut

60399 Torrington Mfg. Co.
Torrington, Connecticut

62460 Deleted

63743 Ward Leonard Electric Co.
Mount Vernon, New York

64834 West Mfg. Co.
San Francisco, California

65092 Weston Instruments Inc.
Newark, New Jersey

66150 Winslow Tele-Tronics Inc.
Asbury Park, New Jersey

70563 Amperite Company
Union City, New Jersey

70903 Belden Mfg. Co.
Chicago, Illinois

71002 Birnbach Radio Co., Inc.
New York, New York

71400 Bussmann Mfg.
Div. of McGraw-Edison Co.
St. Louis, Missouri

71450 CTS Corp.
Elkhart, Indiana

71468 ITT Cannon Electric Inc.
Los Angeles, California

71482 Clare, C P. & Co.
Chicago, Illinois

71590 Centralab
Div. of Globe Union Inc.
Milwaukee, Wisconsin

71707 Coto Coil Co., Inc.
Providence, Rhode Island

71744 Chicago Miniature Lamp Works
Chicago, Illinois

71785 Cinch Mfg. Co. & Howard
B. Jones Div.
Chicago, Illinois

72005 Driver, Wilber B., Co.
Newark, New Jersey

72092 Replaced by 06980

72136 Electro Motive Mfg. Co.
Willimantic, Connecticut

72259 Nytronics Inc.
Berkeley Heights, New Jersey

72354 Deleted

72619 Dialight Corp
Brooklyn, New York

72653 G. C. Electronics
Rockford, Illinois

72665 Replaced by 90303

72794 Dzus Fastener Co., Inc.
West Islip, New York

72928 Gudeman Co.
Chicago, Illinois

72982 Erie Tech. Products Inc.
Erie, Pennsylvania

73138 Beckman Instruments Inc.
Helipot Division
Fullerton, California

73293 Hughes Aircraft Co.
Electron Dynamics Div.
Newport Beach, California

73445 Amperex Electronic Corp.
Hicksville, New York

73559 Carling Electric Inc.
Hartford, Connecticut

73586 Circle F Industries
Trenton, New Jersey

73734 Federal Screw Products, Inc.
Chicago, Illinois

73743 Fischer Special Mfg. Co.
Cincinnati, Ohio

73899 JFD Electronics Co.
Brooklyn, New York

73949 Guardian Electric Mfg. Co.
Chicago, Illinois

74199 Quam Nichols Co.
Chicago, Illinois

74217 Radio Switch Corp.
Marlboro, New Jersey

74276 Signalite Inc.
Neptune, New Jersey

74306 Piezo Crystal Co.
Carlisle, Pennsylvania

74542 Hoyt Elect. Instr. Works
Penacook, New Hampshire

74970 Johnson, E. F., Co.
Waseca, Minnesota

75042 IRC Inc.
Philadelphia, Pennsylvania

75376 Kurz-Kasch, Inc.
Dayton, Ohio

75382 Kulka Electric Corp.
Mt. Vernon, New York

75915 Littlefuse Inc.
Des Plaines, Illinois

76854 Oak Mfg. Co.
Crystal Lake, Illinois

77342 Potter & Brumfield
Div. of Amer. Machine & Foundry
Princeton, Indiana

77969 Rubbercraft Corp. of Calif. LTD.
Torrance, California

78189 Shakeproof
Div. of Illinois Tool Works
Elgin, Illinois

78277 Sigma Instruments, Inc.
South Braintree, Massachusetts

78488 Stackpole Carbon Co.
St. Marys, Pennsylvania

78553 Tinnerman Products
Cleveland, Ohio

79136 Waldes Kohinoor Inc.
Long Island City, New York

79497 Western Rubber Company
Goshen, Indiana

79963 Zierick Mfg. Corp.
New Rochelle, New York

80031 Mepco
Div. of Sessions Clock Co.
Morristown, New Jersey

80145 API Instruments Co.
Chesterland, Ohio

80183 Sprague Products
North Adams, Massachusetts

80294 Bourns Inc.
Riverside, California

80583 Hammarlund Co., Inc.
Mars Hill, North Carolina

80640 Stevens, Arnold Inc.
Boston, Massachusetts

81073 Grayhill Inc.
La Grange, Illinois

81312 Winchester Electronics
Div. of Litton Industries
Oakville, Connecticut

81439 Therm-O-Disc Inc.
Mansfield, Ohio

81483 International Rectifier Corp.
El Segundo, California

81590 Korry Mfg. Co.
Seattle, Washington

82376 Deleted

82389 Switchcraft Inc.
Chicago, Illinois

82415 Price Electric Corp.
Frederick, Maryland

82872 Roanwell Corp.
New York, New York

82877 Rotron Mfg. Co., Inc.
Woodstock, New York

82879 ITT Wire & Cable Div.
Pawtucket, Rhode Island

83003 Varo Inc.
Garland, Texas

83298 Bendix Corp.
Electric Power Division
Eatontown, New Jersey

83330 Smith, Herman H., Inc.
Brooklyn, New York

83478 Rubbercraft Corp. of America
New Haven, Connecticut

83594 Burroughs Corp.
Electronic Components Div.
Plainfield, New Jersey

83740 Union Carbide Corp.
Consumer Products Div.
New York, New York

84171 Arco Electronics, Inc.
Great Neck, New York

84411 TRW
Ogallala, Nebraska

86577 Precision Metal Products
Stoneham, Massachusetts

86684 Radio Corp. of America
Electronic Components & Devices
Harrison, New Jersey

86689 Deleted

87034 Marco-Oak Inc.
Anaheim, California

88419 Use 14655

88690 Replaced by 04217

89536 Fluke, John Mfg. Co., Inc.
Seattle, Washington

89730 Replaced by 08806

90201 Mallory Capacitor Co.
Indianapolis, Indiana

90215 Best Stamp & Mfg. Co.
Kansas City, Missouri

90211 Square D Co.
Chicago, Illinois

90303 Mallory Battery Co.
Tarrytown, New York

91293 Johanson Mfg. Co.
Boonton, New Jersey

91407 Replaced by 58474

91637 Dale Electronics Inc.
Columbus, Nebraska

91662 Elco Corp.
Willow Grove, Pennsylvania

91737 Gremar Mfg. Co., Inc.
Wakefield, Massachusetts

91802 Industrial Devices, Inc.
Edgewater, New Jersey

91836 King's Electronics
Tuckahoe, New York

91929 Honeywell Inc.
Micro Switch Div.
Freeport, Illinois

91934 Miller Electric Co., Inc.
Pawtucket, Rhode Island

93332 Sylvania Electric Products
Semiconductor Products Div.
Woburn, Massachusetts

94145 Replaced by 49956

94154 Tung-Sol
Div. of Wagner Electric Corp.
Newark, New Jersey

95146 Alco Electronics Products Inc.
Lawrence, Massachusetts

95263 Leecraft Mfg. Co.
Long Island City, New York

95264 Replaced by 98278

95275 Vitramon Inc.
Bridgeport, Connecticut

95303 Radio Corp. of America
Solid State & Receiving Tube Div.
Cincinnati, Ohio

95354 Methode Mfg. Corp.
Rolling Meadows, Illinois

95712 Dage Electric Co., Inc.
Franklin, Indiana

95987 Weckesser Co., Inc.
Chicago, Illinois

96733 San Fernando Electric Mfg. Co.
San Fernando, California

96853 Rustrak Instrument Co.
Manchester, New Hampshire

96881 Thomson Industries, Inc.
Manhasset, New York

97540 Master Mobile Mounts
Div. of Whitehall Electronics Corp.
Los Angeles, California

97913 Industrial Electronic Hdware Corp.
New York, New York

97945 White, S. S. Co.
Plastics Div.
New York, New York

97966 Replaced by 11358

98094 Replaced by 49956

98278 Microdot Inc.
Pasadena, California

98291 Sealectro Corp.
Conhex Div
Mamaroneck, New York

98388 Accurate Rubber & Plastics
Culver City, California

98743 Replaced by 12749

98925 Deleted

99120 Plastic Capacitors, Inc.
Chicago, Illinois

99217 Southern Electronics Corp.
Burbank, California

99515 Marshall Industries
Capacitor Div.
Monrovia, California

Revised August 1, 1968
Using H4-1 and H4-2
Dated June , 1968

WARRANTY

The JOHN FLUKE MFG. CO., INC. warrants each instrument manufactured by them to be free from defects in material and workmanship. Their obligation under this Warranty is limited to servicing or adjusting an instrument returned to the factory for that purpose, and to making good at the factory any part or parts thereof; except tubes, fuses, choppers and batteries, which shall, within one year after making delivery to the original purchaser, be returned by the original purchaser with transportation charges prepaid, and which upon their examination shall disclose to their satisfaction to have been thus defective. If the fault has been caused by misuse or abnormal conditions of operation, repairs will be billed at a nominal cost. In this case, an estimate will be submitted before work is started, if requested.

If any fault develops, the following steps should be taken.

1. Notify the John Fluke Mfg. Co., Inc., giving full details of the difficulty, and include the Model number, type number, and serial number. On receipt of this information, service data or shipping instructions will be forwarded to you.

2. On receipt of the shipping instructions, forward the instrument prepaid, and repairs will be made at the factory. If requested, an estimate of the charges will be made before the work begins, provided the instrument is not covered by the Warranty.

SHIPPING

All shipments of John Fluke Mfg. Co., Inc. instruments should be made via Railway Express prepaid. The instrument should be shipped in the original packing carton; or if it is not available, use any suitable container that is rigid. If a substitute container is used, the instrument should be wrapped in paper and surrounded with at least four inches of excelsior or similar shock-absorbing material.

CLAIM FOR DAMAGE IN SHIPMENT

The instrument should be thoroughly inspected immediately upon receipt. All material in the container should be checked against the enclosed packing list. The manufacturer will not be responsible for shortages against the packing sheet unless notified immediately. If the instrument fails to operate properly, or is damaged in any way, a claim should be filed with the carrier. A full report of the damage should be obtained by the claim agent, and this report should be forwarded to John Fluke Mfg. Co., Inc. Upon receipt of this report you will be advised of the disposition of the equipment for repair or replacement. Include the model number, type number, and serial number when referring to this instrument for any reason.

The John Fluke Mfg. Co., Inc. will be happy to answer all application questions which will enhance your use of this instrument. Please address your requests to:

JOHN FLUKE MFG. CO., INC., P. O. BOX 7428, SEATTLE 33, WASHINGTON

Sales and Service Representatives

ALABAMA

HUNTSVILLE
BCS Associates, Inc.
2317 Bob Wallace Ave. S.W.
Tel. (205) 534-1648
Zip 35805

ALASKA

SEATTLE
Instrument Specialists, Inc.
5950 Sixth Ave. South
Suite 106
Seattle, Washington 98108
Tel. (206) 767-4260

ARIZONA

PHOENIX
Barnhill Associates
4900 E. Indian School Road
Tel. (602) 959-2115
Zip 85251

CALIFORNIA

LOS ANGELES
Instrument Specialists, Inc.
1109 S. Central Ave.
Glendale, California 91204
Tel. (213) 245-9404

SAN FRANCISCO
Instrument Specialists, Inc.
2359 De La Cruz
Santa Clara, California 95050
Tel. (408) 244-1505

SAN DIEGO
Instrument Specialists Inc.
Crosstown Financial Bldg.
1909 State Street, Room No. 7
Zip 92101

COLORADO

DENVER
Barnhill Associates
1170 S. Sheridan Blvd.
Tel. (303) 934-5505
Zip 80226

CONNECTICUT

HARTFORD
Instrument Representatives, Inc.
P.O. Box 165
Glastonbury, Connecticut 06033
Tel. (203) 633-0777

FLORIDA

ORLANDO
BCS Associates, Inc.
940 N. Fern Creek Ave.
Tel. (305) 425-2764
Zip 32803

HAWAII

HONOLULU
Industrial Electronics, Inc.
646 Queen Street
Tel. (808) 506-095
Zip 96813

ILLINOIS

CHICAGO
Cozzens & Cudahy, Inc.
9501 W. Devon Ave.
Rosemont, Illinois 60018
Tel. (312) 825-1144

INDIANA

INDIANAPOLIS
Cozzens & Cudahy, Inc.
44 Kirk Drive
Tel. (317) 244-2456
Zip 46234

MARYLAND

BALTIMORE
Electronic Marketing Assoc.
11501 Huff Court
Kensington, Maryland 20795
Tel. (301) 744-7700

MASSACHUSETTS

BOSTON
Instrument Representatives, Inc.
1046 Massachusetts Avenue
Arlington, Massachusetts 02174
Tel. (617) 646-1034

MICHIGAN

DETROIT
Technitron, Inc.
13657 Grand River Ave.
Tel. (313) 838-7324
Zip 48227

MINNESOTA

MINNEAPOLIS
Cozzens & Cudahy, Inc.
7710 Computer Ave.
Tel. (612) 920-1022
Zip 55435

MISSOURI

ST. LOUIS
Cozzens & Cudahy, Inc.
P.O. Box 10013
Lambert Field 63145
Tel. (314) 423-1234

NEW JERSEY

NEWARK
SBM Associates, Inc.
1519 Stuyvesant Avenue
Union, New Jersey 07083
Tel. (201) 687-8737

NEW MEXICO

ALBUQUERQUE
Barnhill Associates
827 Pennsylvania N.E.
Tel. (505) 265-7766
Zip 87110

NEW YORK

NEW YORK
SBM Associates, Inc.
28 Hobby Street
Pleasantville, New York 10570
Tel. (914) 769-1811

LONG ISLAND
SBM Associates, Inc.
528 Old Country Road
Plainview, Long Island 11803
Tel. (516) 433-1421

ROCHESTER
SBM Associates, Inc.
800 Linden Avenue
Tel. (716) 381-8330
Zip 14625

SYRACUSE
SBM Associates, Inc.
138 Pickard Bldg.
5858 E. Molloy Road
Tel. (315) 454-9377
Zip 13211

NORTH CAROLINA

GREENSBORO
BCS Associates, Inc.
1039 E. Wendover Avenue
Tel. (919) 273-1918
Zip 27405

OHIO

CLEVELAND
Technitron, Inc.
23203 Lorain Road
North Olmsted, Ohio 44070
Tel. (216) 734-0960

DAYTON
Technitron, Inc.
1250 W. Dorothy Lane
Tel. (513) 298-9964
Zip 45409

OREGON

PORTLAND
Instrument Specialists, Inc.
5950 Sixth Ave. South
Suite 106
Seattle, Washington 98108
Tel. (206) 767-4260

PENNSYLVANIA

PHILADELPHIA
Electronic Marketing Assoc.
210 Goddard Blvd. — Suite 100
King of Prussia, Pennsylvania
Tel. (215) 248-5050 Zip 19406

PITTSBURGH
Technitron, Inc.
114 Spring Grove Road
Tel. (412) 371-1231
Zip 15235

TEXAS

DALLAS
Barnhill Associates
507B Bishop Street
Richardson, Texas 75080
Tel. (214) 231-2573

HOUSTON
Barnhill Associates
Suite 332
3810 Westheimer
Tel. (713) 621-0040
Zip 77027

WASHINGTON

SEATTLE
Instrument Specialists, Inc.
5950 Sixth Ave. South
Suite 106
Seattle, Washington 98108
Tel. (206) 767-4260

WASHINGTON, D.C.

Electronic Marketing Associates
11501 Huff Court
Kensington, Maryland 20795
Tel. (301) 946-0300

CANADA

BRITISH COLUMBIA

VANCOUVER
Allan Crawford Associates, Ltd.
721 Aldford Ave.
Annacis Industrial Estate
New Westminster
Tel. (604) 524-1161

ONTARIO

OTTAWA, 3
Allan Crawford Associates, Ltd.
376 Churchill Avenue — Suite 106
Tel. (613) 725-1288

TORONTO
Allan Crawford Associates, Ltd.
65 Martin Ross Avenue
Downsview, Ontario
Tel. (416) 636-4910

QUEBEC

MONTREAL, 8
Allan Crawford Associates, Ltd.
1285 Hodge Street
Tel. (514) 747-9849

International Representatives

AUSTRALIA
Elmesco Instruments
7 Chard Road
P.O. Box 334
Brookvale, N.S.W., Australia 2100

AUSTRIA
Omni Ray AG
Tech. Beratung
Mollardgasse 54
Vienna VI, Austria

BELGIUM
C. N. Rood S/A
30 Rue Leon Frederic
Brussels 4, Belgium

DENMARK
Tage Olsen A/S
1, Ronnegade
Copenhagen, Denmark

FINLAND
Oy Findip AB
Postbox 52025
Helsinki 25, Finland

FRANCE
Radio Equipment Antares
9, Rue Ernest Cognac Q
92 Levallois
Perret, France

HONG KONG and MACAO
Intronics Ltd.
4 Hankow Road, Suite 4A
Kowloon, Hong Kong

ISRAEL
R. D. T. Electronics Engineering Ltd.
P.O. Box 21082
Tel-Aviv, Israel

ITALY
Elettronucleonica s. p. a.
7, P.zza DeAngeli
20146 Milano, Italy

JAPAN
Toyo Trading Co., Ltd.
P.O. Box 5014
Tokyo, Japan
Toyo Trading Co., Ltd.
2-38 Junkeicho-dori minami-ku
Osaka, Japan

KOREA
M. - C International
I. P.O. Box 1355
Seoul, Korea

MALAYSIA
O'Connor's (Pte.) Limited
P.O. Box 1197
Kota, Kinabalu
East Malaysia
O.Connor's (Pte.) Limited
P.O. Box 91
Petaling Jaya
West Malaysia

THE NETHERLANDS
C. N. Rood N. V.
Post Office Box 4542
Rijswijk (Z. H.) The Netherlands
Fluke (Nederland) N. V.
Post Office Box 5053
Tilburg, The Netherlands

NEW ZEALAND
Sample Electronics (N. Z.) Ltd.
P.O. Box 13258
Auckland 6, New Zealand

NORWAY
Morgenstierne & Co. A/S
P.B. 6688 Rodelokka
Oslo 6, Norway

OKINAWA
RYUKYU ISLANDS
Baxter Trading Co.
P.O. Box 26
Koza, Okinawa
Ryukyu Islands

PHILIPPINES
T. J. Wolff
2246 Pasong Tamo
Makati, Rizal
Manila, Philippines

SINGAPORE
O'Connor's (Pte.) Limited
Maybank House
Robinson Road
Singapore

SOUTH AFRICA
K. Baker (Pty.) Ltd.
P.O. Box 1257
Johannesburg, So. Africa

K. Baker (Pty.) Ltd.
P.O. Box 3641
Cape Town, So. Africa

K. Baker (Pty.) Ltd.
P.O. Box 2143
Durban, Natal, So. Africa

SPAIN
REMA
General Sanjurjo, 18
Madrid, Spain

SWEDEN
Robert E. O. Olsson
Box 165
Tradgardsgatan 7
Motala, Sweden

SWITZERLAND
Omni Ray AG
Dufourstrasse 56
8008 Zurich, Switzerland

TAIWAN
Heighten Trading Co., Ltd.
P.O. 1408
Taipei, Taiwan

THAILAND
G. Simon Radio Ltd.
30 Patpong Avenue
Suriwong
Bangkok, Thailand

THE UNITED KINGDOM
Fluke International Corp.
Garnett Close
Watford, England
WD2-4TT

WEST GERMANY
Rohde & Schwarz Vertriebs - Gmbh
5000 Koeln
Hohe Strasse 160-168
West Germany

Rohde & Schwarz Handels - Gmbh
1000 Berlin 10
Ernst - Reuter - Platz 10
West Germany

Rohde & Schwarz Vertriebs - Gmbh
2000 Hamburg 50
Grosse Bergstrasse 213-217
West Germany

Rohde & Schwarz Vertriebs - Gmbh
7500 Karlsruhe
Kriegsstrasse 39
West Germany

Rohde & Schwarz Vertriebs - Gmbh
8000 Muenchen
Dachauer Strasse 109
West Germany

In Europe contact FLUKE NEDERLAND, N. V., Post Office Box 5053, Tilburg, The Netherlands

FLUKE®

List of Factory Authorized Service Centers

ARIZONA

PHOENIX

Arizona Standards Laboratory
4430 N. 19th Ave.
Tel. (602) 264-9351

CALIFORNIA

LOS ANGELES

Instrument Specialists, Inc.
P. O. Box 39908
2870 Los Feliz Place
Tel. (213) 665-5181
TWX: 910-321-3914

COLORADO

BOULDER

Ball Brothers Research Corp.
Standardization Laboratory
Tel. (303) 444-5300
TWX: 910-940-3241

FLORIDA

ORLANDO

BCS Associates, Inc.
P. O. Box 6578
940 N. Fern Creek Ave.
Tel. (305) 425-2764
TWX. 810-850-0185

HAWAII

HONOLULU

Industrial Electronics
P. O. Box 135
646 Queen Street
Tel. (808) 506-095
TWX. 63238

MARYLAND

KENSINGTON

Electronic Marketing Associates
11501 Huff Court
Tel. (301) 946-0300
TWX. 710-825-9645

MASSACHUSETTS

ARLINGTON

Instrument Representatives, Inc.
1046 Massachusetts Ave.
Tel. (617) 646-1034

NEW MEXICO

ALBUQUERQUE

EG & G Standards and Calibration Laboratory
P. O. Box 4339, Station A
933 Bradbury Drive S. E.
Tel. (505) 842-4084

NEW YORK

PLEASANTVILLE

SBM Associates
28 Hobby Street
Tel. (914) 769-1811
TWX. 710-572-2193

ROCHESTER

SBM Associates
800 Linden Ave.
Tel. (716) 381-8330
TWX. 510-253-6145

OHIO

CLEVELAND

Honeywell Metrology Service
1001 E. 55th St.
Tel. (216) 881-0300

FAIRBORN

Honeywell Metrology Service
600 East Dayton Dr.
Tel. (513) 878-2551

TEXAS

GARLAND

Tucker Electronics Company
326 Kirby Street
Tel. (214) 272-3404

HOUSTON

Linear Standards Laboratory
8207 Millet
Tel. (713) 923-2796

UTAH

SALT LAKE CITY

Stabro Laboratory
23 Kensington Ave.
Tel. (801) 467-8011

CANADA

TORONTO

Allen Crawford Associates Ltd.
65 Martin Ross Ave.
Downsview, Ontario
Tel. (416) 636-4910
TWX. 610-492-2119

INTERNATIONAL

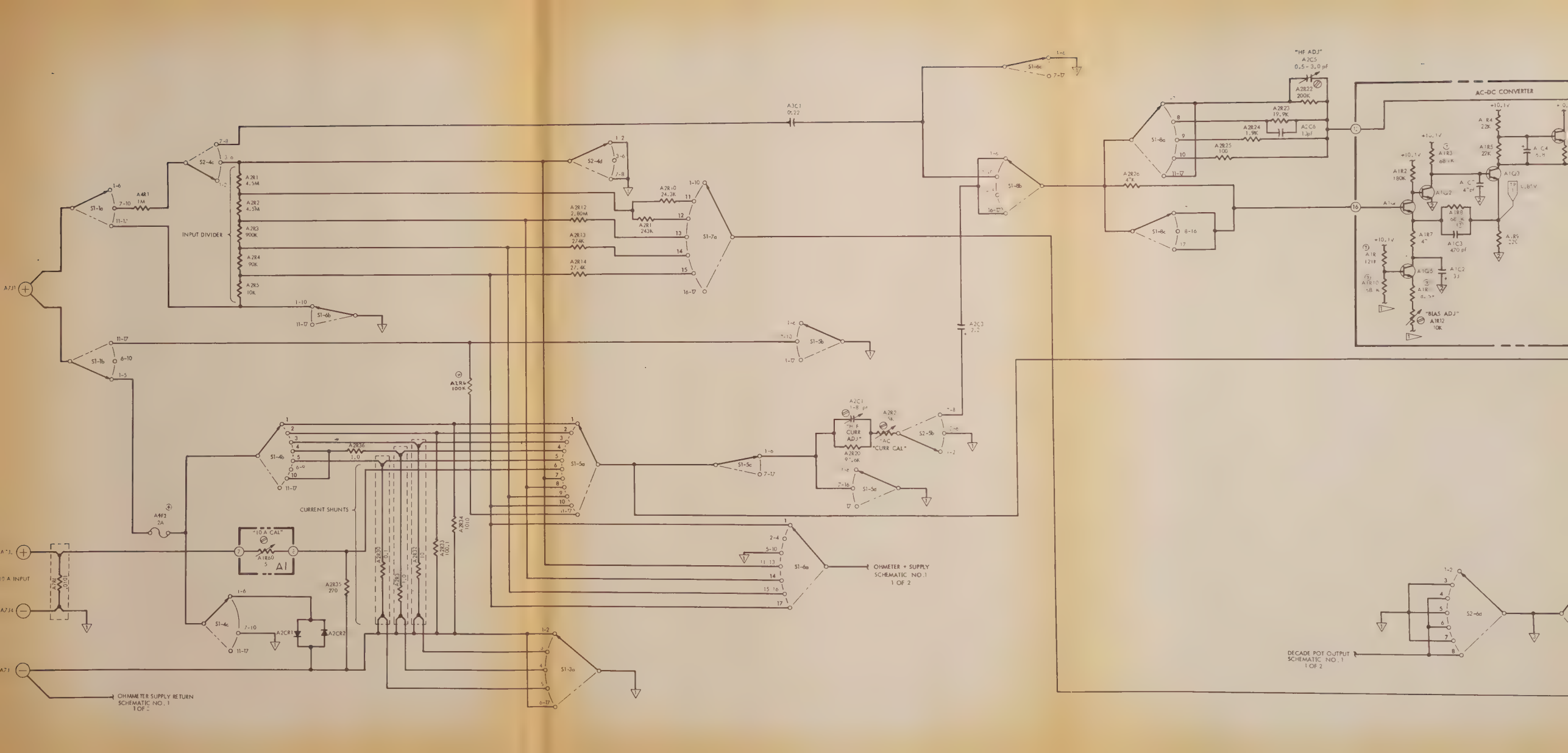
THE NETHERLANDS

Fluke Netherland N. V.
P. O. Box 5053
Tilburg, The Netherlands

UNITED KINGDOM

Fluke International Corp
P. O. Box 102
Watford-Herts, England

For information regarding service centers in other foreign locations, contact the nearest Sales and Service Representative in your area.


INPUT DIVIDER
A2R1 4.5M
A2R2 4.5M
A2R3 900K
A2R4 90K
A2R5 10K
A4R1 1M
A2R6 100K
A2R36 1.0
A2R34 100.1
A2R33 100.1
A2R32 1.0
A2R31 10
A2R30 0.1
A2R29 1.0
A2R35 270
A4F2 2A
A1R60 5
"10 A CAL"
A1
CURRENT SHUNTS
10 A INPUT
A4R4 0.01
A2CR1
A2CR2
A2R12 2.80M
A2R13 274K
A2R14 27.4K
A2R10 24.3K
A2R11 243K
A3C1 0.22
A2C3 7.2
A2C1 1-8 pf
"HF CURR ADJ"
A2R20 9.76K
A2R21 5k
"AC CURR CAL"
"HF ADJ"
A2C5 0.5 - 3.0 pf
A2R22 200K
A2R23 19.9K
A2R24 1.9K
A2C6 1.3pf
A2R25 100
A2R26 47K
AC-DC CONVERTER
+10.1V
A1R4 22K
A1R5 27K
A1R3 68.1K
A1R2 180K
A1R8 68.1K
A1R7 4^
A1C3 470 pf
A1R 121?
A1R10 58.1K
A1R12 10K
"BIAS ADJ"
A1C4 5.1
A1C5 3.3
A1C2 3.3
A1RS 22C
A1Q1
A1Q2
A1Q3
A1Q4
A1Q5
A7J1
A7J2
A7J3
A7J4
OHMMETER + SUPPLY SCHEMATIC NO. 1 1 OF 2
OHMMETER SUPPLY RETURN SCHEMATIC NO. 1 1 OF 2
DECADE POT OUTPUT SCHEMATIC NO. 1 1 OF 2

FOR NOTES SEE SCHEMATIC NO. 1 1 OF 2

SWITCH FUNCTIONS.

RANGE SWITCH - S1	
POSITION	FUNCTION
1	.1 MA
2	1 MA
3	10 MA
4	100 MA
5	1000 MA
6	10 A
7	1 VOLTS
8	10 VOLTS
9	100 VOLTS
10	1000 VOLTS
11	100M OHMS
12	10M OHMS
13	1M OHMS
14	100K OHMS
15	10K OHMS
16	1000 OHMS
17	100 OHMS

MODE SWITCH - S2	
POSITION	FUNCTION
1	BAT CHK
2	OFF
3	+ DC DIR
4	+ DC DIFF
5	- DC DIR
6	- DC DIFF
7	AC DIR
8	AC DIFF

TO A1 PIN 4 SCHEMATIC NO. 1 1 OF 2

A1

NULL DETECTOR AMPLIFIER

NULL DETECTOR OUTPUT (±1V)

"MTR CAL"

"DIFF -"

"DIFF +"

"AC CAL"

A1T. 853A-6010

INVERTER/ISOLATOR

SCHEMATIC NO. 1 1 OF 2

"NULL SENS" A3R15 1K

FUNCTIONAL SCHEMATIC

SCHEMATIC NO. 1 OF 2

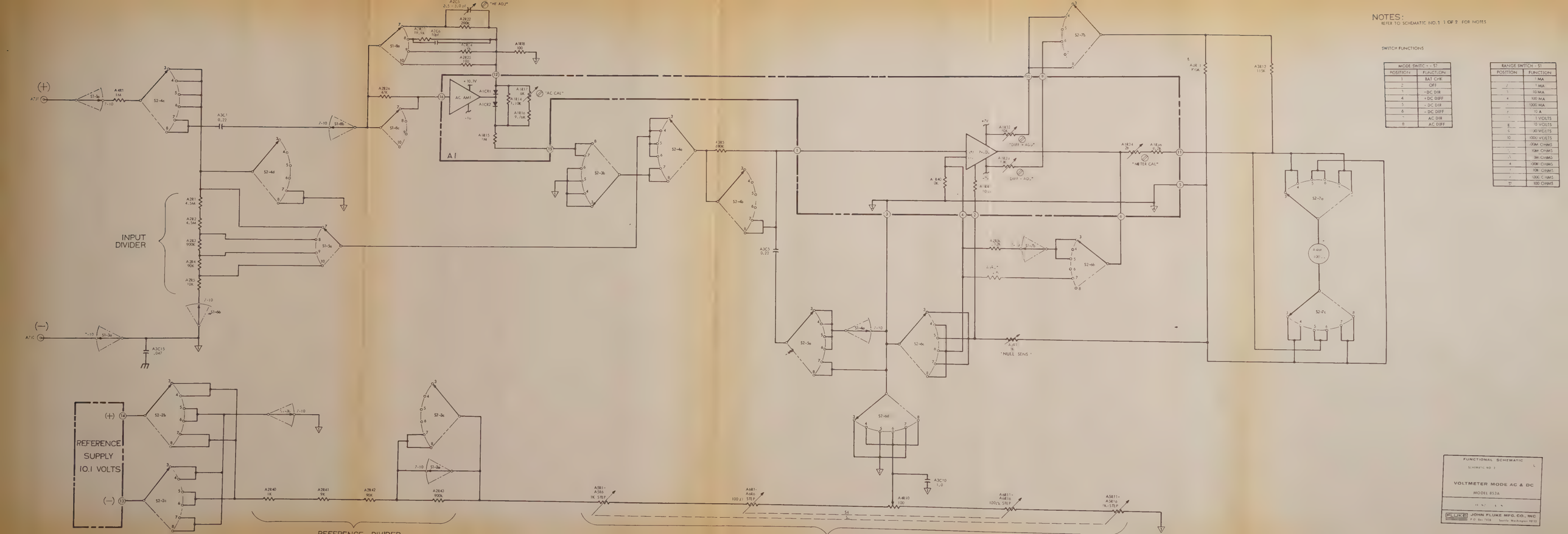
MULTIMETER

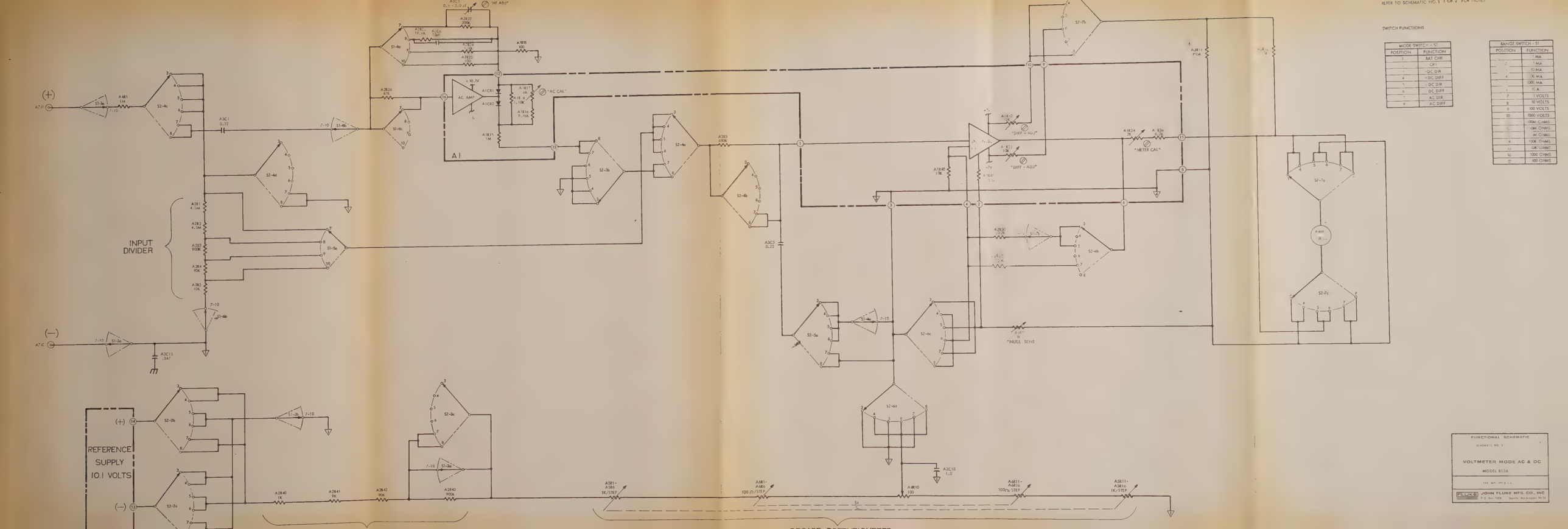
MODEL 853A

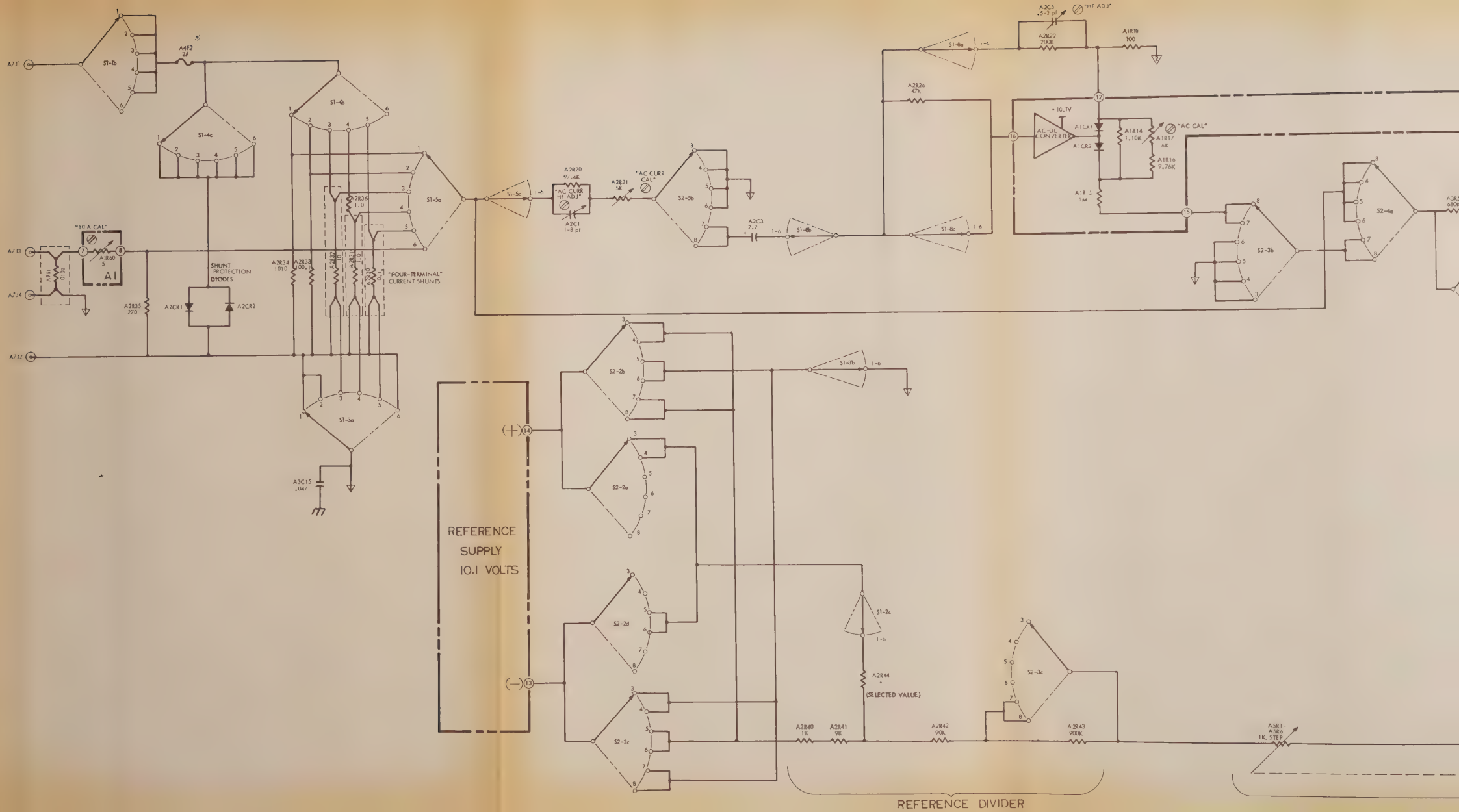
SER NO 121 & ON

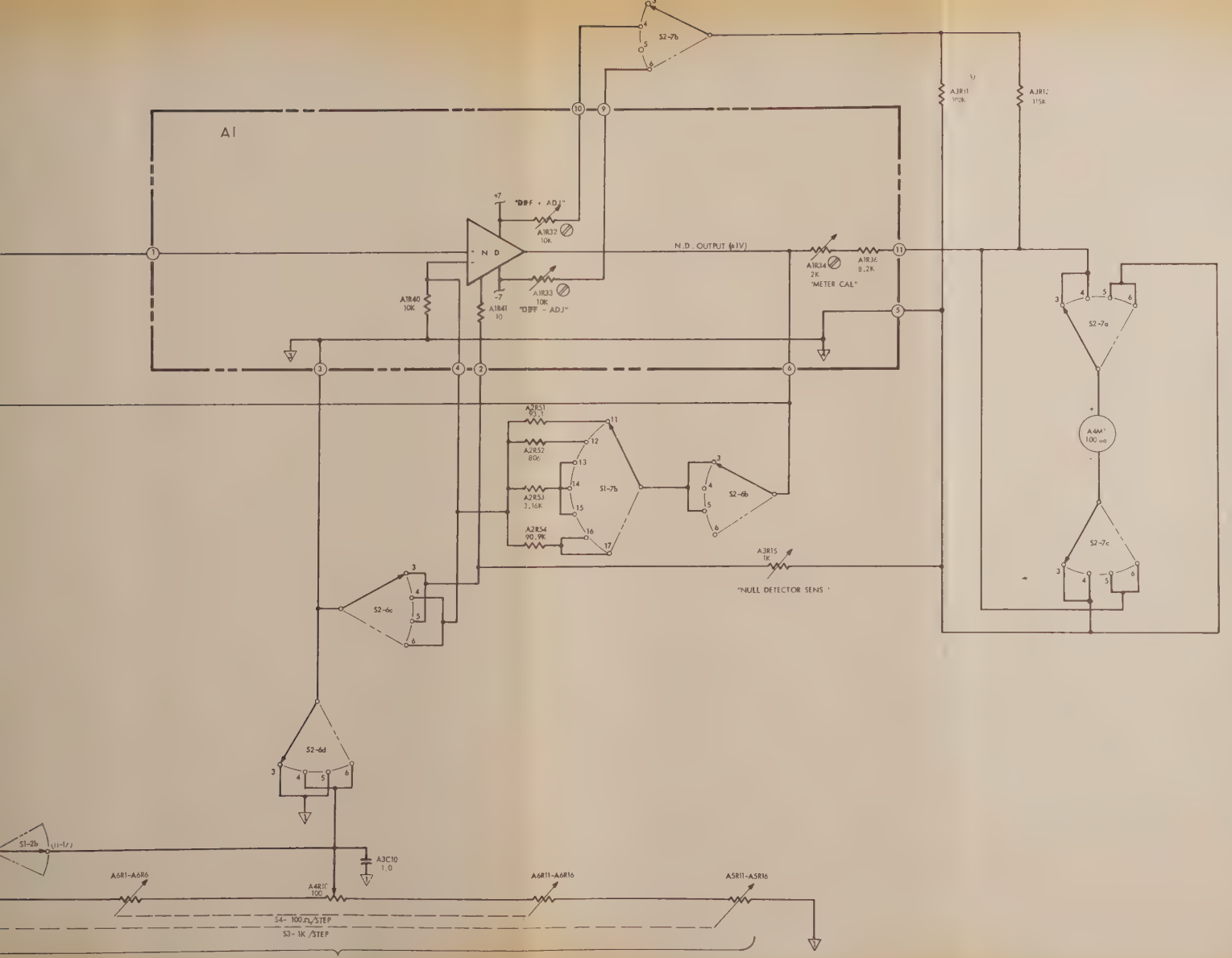
FLUKE JOHN FLUKE MFG CO., INC

P O Box 7428 Seattle Washington 98133


NOTES:
REFER TO SCHEMATIC NO. 1 OF 2 FOR NOTES
SWITCH FUNCTIONS
MODE SWITCH - S7
POSITION | FUNCTION
1 | BAT CHK
2 | OFF
3 | +DC DIR
4 | +DC DIFF
5 | -DC DIR
6 | -DC DIFF
7 | AC DIR
8 | AC DIFF
RANGE SWITCH - S1
POSITION | FUNCTION
1 MA
2 1 MA
3 10 MA
4 100 MA
1000 MA
7 10 A
1 VOLTS
9 10 VOLTS
5 100 VOLTS
10 1000 VOLTS
100M OHMS
10M OHMS
3M OHMS
4 1000K OHMS
100K OHMS
7 10K OHMS
100 OHMS
INPUT DIVIDER
REFERENCE SUPPLY 10.1 VOLTS
REFERENCE DIVIDER
"HF ADJ"
"AC CAL"
"DIFF + ADJ"
"DIFF - ADJ"
"METER CAL"
"NULL SENS"
A1
FUNCTIONAL SCHEMATIC
SCHEMATIC NO. 2
VOLTMETER MODE AC & DC
MODEL 833A
JOHN FLUKE MFG. CO., INC


REFERENCE SUPPLY 10.1 VOLTS
INPUT DIVIDER
A1
AC AMP
"AC CAL"
"HF ADJ"
"DIFF – ADJ"
"METER CAL"
"NULL SENS"
SWITCH FUNCTIONS
MODE SWITCH – S2
POSITION | FUNCTION
1 | BAT CHK
– | OFF
– | + DC DIR
4 | + DC DIFF
5 | – DC DIR
6 | DC DIFF
7 | AC DIR
8 | AC DIFF
RANGE SWITCH – S1
POSITION | FUNCTION
1 | 1 MA
2 | 3 MA
3 | 10 MA
4 | 30 MA
5 | 100 MA
6 | 1 A
7 | 3 VOLTS
8 | 10 VOLTS
9 | 100 VOLTS
10 | 1000 VOLTS
– | 100M OHMS
– | 10M OHMS
– | 1M OHMS
4 | 100K OHMS
5 | 10K OHMS
16 | 1000 OHMS
17 | 100 OHMS
FUNCTIONAL SCHEMATIC
SCHEMATIC NO 2
VOLTMETER MODE AC & DC
MODEL 853A
JOHN FLUKE MFG. CO., INC.
P.O. Box 7428 Seattle, Washington 98133


A7J1
A7J3
A7J4
A7J2
S1-1b
S1-4c
S1-4b
S1-5a
S1-5c
S1-3a
S1-6a
S1-6c
S1-6b
S1-3b
S2-5b
S2-2b
S2-2a
S2-2d
S2-2c
S2-3b
S2-4a
S2-3c
S1-2c
A4F2
2A
"10 A CAL"
A1R60
5
A1
A2R1
.005
SHUNT PROTECTION DIODES
A2CR1
A2CR2
A2R35
270
A2R34
1010
A2R33
100
A2R32
10
A2R31
1.0
"FOUR-TERMINAL" CURRENT SHUNTS
A3C15
.047
A2R20
97.6K
"AC CURR HF ADJ"
A2C1
1-8 pf
A2R21
5K
"AC CURR CAL"
A2C3
2.2
A2C5
.5-3 pf
"HF ADJ"
A2R22
200K
A1R18
100
A2R26
47K
+10.1V
AC-DC CONVERTER
A1CR1
A1CR2
A1R14
1.10K
A1R17
6K
"AC CAL"
A1R16
9.76K
A1R 5
1M
REFERENCE SUPPLY 10.1 VOLTS
(+)14
(−)13
A2R40
1K
A2R41
9K
A2R42
90K
A2R43
900K
A2R44
*
(SELECTED VALUE)
A5R1-A5R6
1K, STEP
REFERENCE DIVIDER



NOTES :

REFER TO SCHEMATIC NO. 1 1 OF 2 FOR NOTES

SWITCH FUNCTIONS :

MODE SWITCH - S2	
POSITION	FUNCTION
1	BAT CHK
2	OFF
3	+ DC DIR
4	+ DC DIFF
5	- DC DIR
6	- DC DIFF
7	AC DIR
8	AC DIFF

RANGE SWITCH - S1	
POSITION	FUNCTION
1	1 MA
2	1 MA
3	10 MA
4	100 MA
5	1000 MA
6	10 A
7	VOLTS
8	10 VOLTS
9	100 VOLTS
10	1000 VOLTS
11	100M OHMS
12	10M OHMS
13	M OHMS
14	00K OHMS
15	10K OHMS
16	1000 OHMS
17	100 OHMS

FUNCTIONAL SCHEMATIC

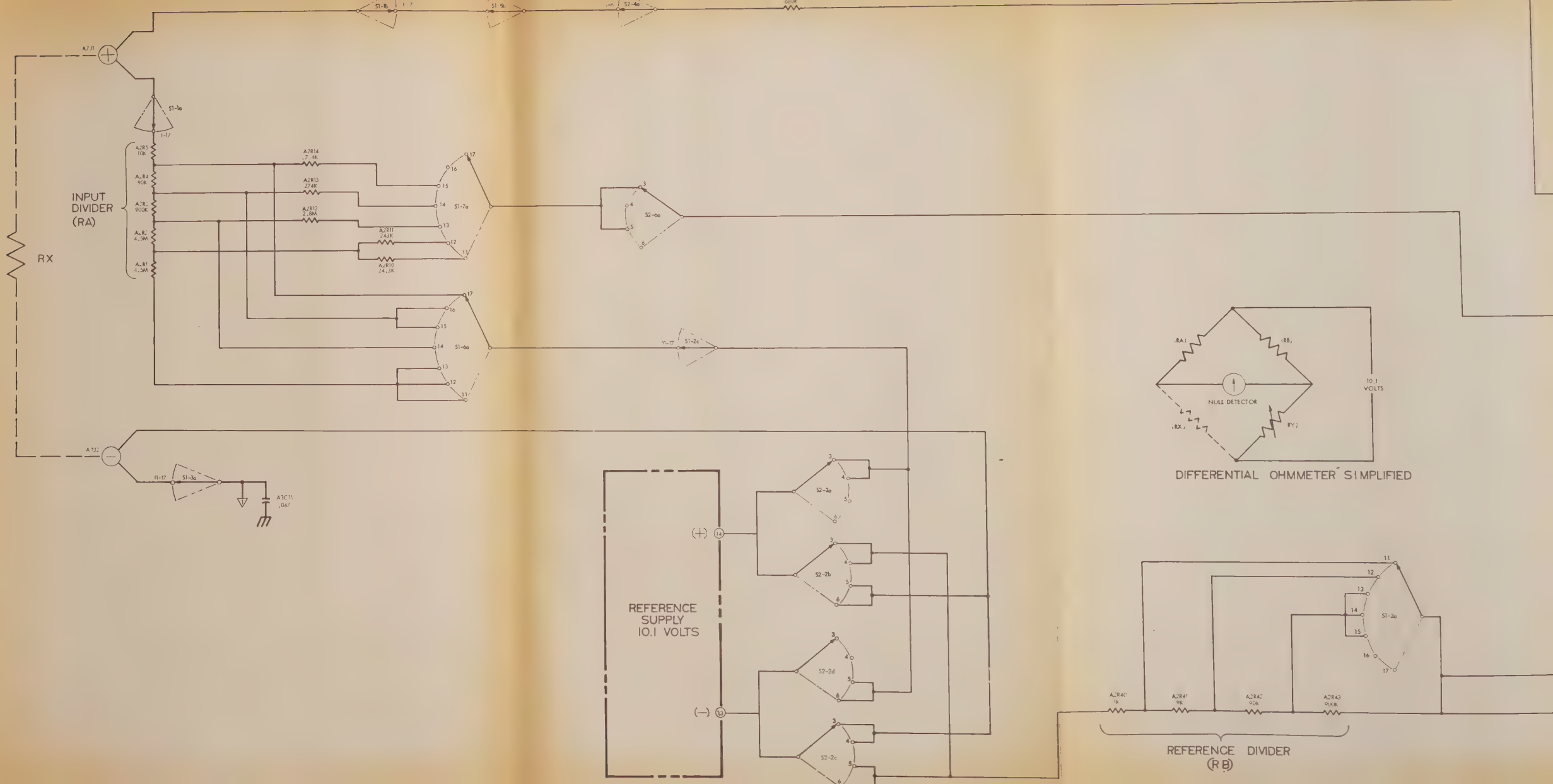
SCHEMATIC NO. 4

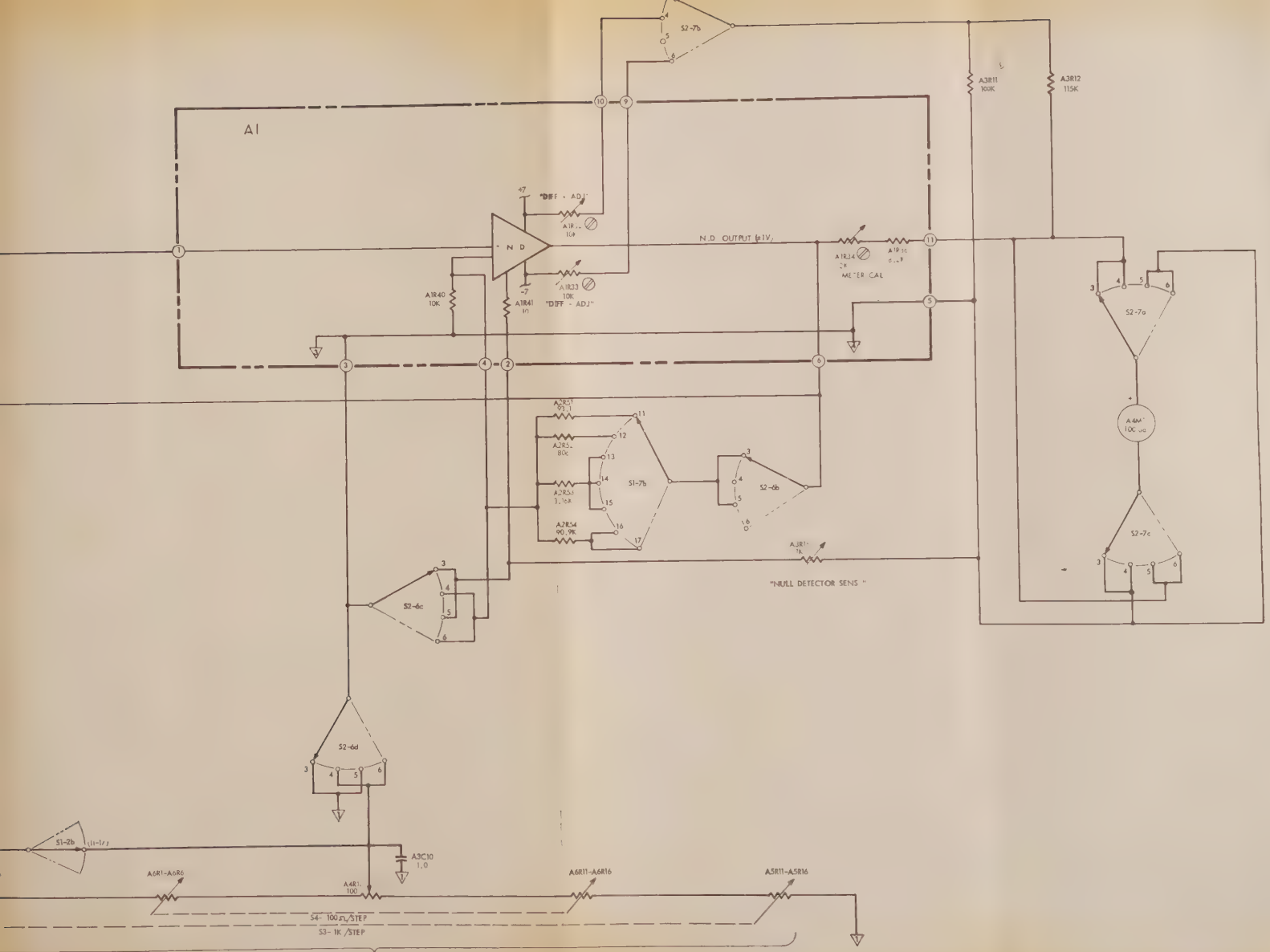
OHMMETER MODE

MODEL 853A

SER NO 121 & ON

FLUKE JOHN FLUKE MFG. CO., INC
P.O. Box 7428 Seattle, Washington 98133


INPUT DIVIDER (RA)
RX
REFERENCE SUPPLY 10.1 VOLTS
DIFFERENTIAL OHMMETER SIMPLIFIED
NULL DETECTOR
10.1 VOLTS
REFERENCE DIVIDER (RB)



NOTES:

REFER TO SCHEMATIC NO 1 1 OF 2 FOR NOTES

SWITCH FUNCTIONS:

MODE SWITCH - S2	
POSITION	FUNCTION
1	BAT CHK
2	OFF
3	+ DC DIR
4	+ DC DIFF
5	- DC DIR
6	- DC DIFF
7	AC DIR
8	AC DIFF

RANGE SWITCH - S1	
POSITION	FUNCTION
1	.1 MA
2	1 MA
3	10 MA
4	100 MA
5	1,000 MA
6	10 A
7	1 VOLTS
8	10 VOLTS
9	100 VOLTS
10	1000 VOLTS
11	100M OHMS
12	10M OHMS
13	1M OHMS
14	100K OHMS
15	10K OHMS
16	1000 OHMS
17	100 OHMS

FUNCTIONAL SCHEMATIC

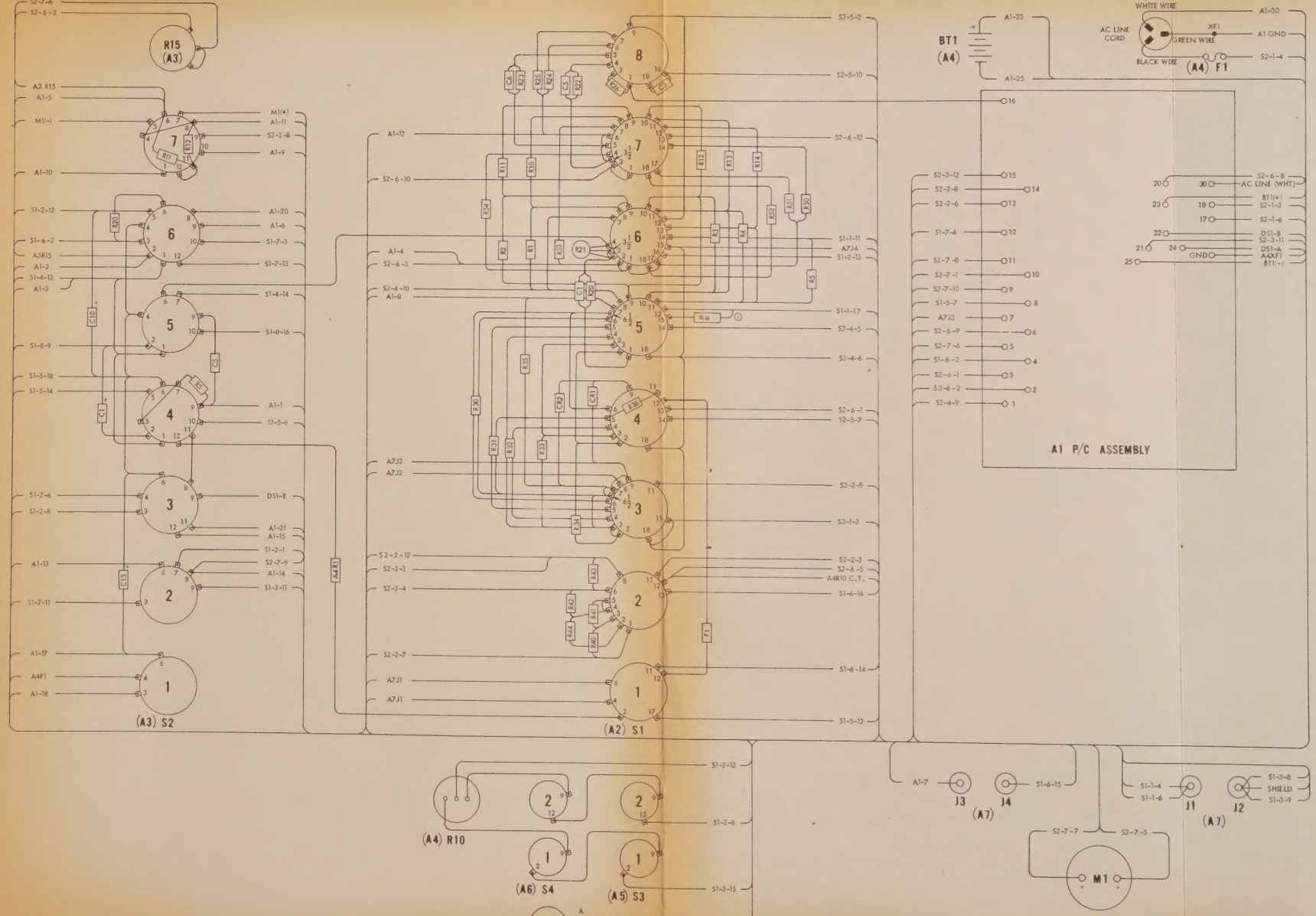
SCHEMATIC NO 4

OHMMETER MODE

MODEL 853A

SER NO 123 & ON

FLUKE JOHN FLUKE MFG. CO., INC.
P.O. Box 7428 Seattle, Washington 98133



NOTES:

WIRING AS VIEWED FROM BOTTOM OF INSTRUMENT

S1 - 4 - 14

SWITCH NO. DECK TERMINAL

CHANGES:

① FOR SER.NO. 903, 913, 923, 938, AND ON: A2R6 100K ADDED TO (A2) S1 DECK 5.

WIRING DIAGRAM
SCHEMATIC NO. 5
MULTIMETER
MODEL 853A
SER. NO. 103 & ON
FLUKE JOHN FLUKE MFG. CO., INC. P.O. Box 7428 Seattle, Washington 98133

www.manualsplus.com
1020832